Honolulu High-Capacity Transit Corridor Project
Alternatives Analysis

Draft and Final Model Re-Calibration and Validation Report

Draft and Final LPA Travel Forecasts

June 2007

Prepared for:
City and County of Honolulu

Prepared by:
Parsons Brinckerhoff

Table of Contents

1.0 INTRODUCTION 1-1

2.0 MODEL RE-CALIBRATION AND VALIDATION 2-1

2.1 Review of Previous Model Enhancements 2-1

2.2 Summary of On-Board Survey Expansion 2-1

2.3 Summary of On-Board Survey Assignment Analysis 2-1

2.4 Preparation of Calibration Target Values 2-1

2.5 Model Calibration Results (2005) 2-1

2.6 Model Validation Results (2005) 2-2

3.0 TRAVEL FORECASTS 3-1

3.1 Analysis of the 2030 No-Build Forecast 3-1

3.2 Status of Travel Forecasts (2030) 3-1

3.3 Preliminary User Benefit Results 3-2

3.4 Non-Included Attribute Tests 3-2

3.5 NHB Direct Demand Model Estimation & Application 3-2

APPENDIX A 2005 ON-BOARD SURVEY ASSIGNMENT & ANALYSIS

APPENDIX B 2005 CALIBRATION TARGET VALUE PREPARATION

APPENDIX C 2005 CALIBRATION RESULTS

APPENDIX D 2005 OBSERVED & ESTIMATED RESULTS

APPENDIX E 2030 FORECAST SUMMARY

APPENDIX F USER BENEFIT RESULTS

APPENDIX G NHB DIRECT DEMAND ESTIMATION/APPLICATION

1.0 Introduction

A review meeting was held with Federal Transit Administration (FTA) staff in Washington, D.C. on May 21, 2007. A variety of topics were discussed as shown in the Agenda on the following page.

Detailed discussions were held concerning re-calibration and validation of the O'ahu Travel Forecasting model and on travel forecasts prepared for the No-Build, Baseline and Build (LPA) alternatives. These topics are shown on the Agenda under Heading 2. Travel Forecasting Topics – Work to Support Application to Enter Preliminary Engineering. The information presented to FTA for their review and comment, as described in the following chapters, constitute documentation of Product 10.5 Model Re-Calibration and Validation Report and of Product 12.0.6 LPA Travel Forecasts. The agenda item discussions associated with Model Re-Calibration and Validation are included in Chapter 2 of this document; the agenda item discussions associated with LPA Travel Forecasts are included in Chapter 3 of this document. Both chapters are divided into subsections corresponding to the bulleted items on the FTA Agenda.

Honolulu High-Capacity Transit Corridor Project

Review Meeting with Federal Transit Administration

May 21, 2007

Agenda

1. Status of Application to Enter Preliminary Engineering
   - Scoping Report
   - Project Management Plan
   - Cost Estimates
   - Financial Plan
   - New Starts Criteria Report

2. Travel Forecasting Topics
   - Review of the Alternative Definitions
     - No-Build
     - Baseline
     - Build
   - Work to Support Application to Enter Preliminary Engineering
     - Review Of Previous Model Enhancements
     - Summary of On-Board Survey Expansion
     - Summary of On-Board Survey Assignment Analysis
       - Access Connector and path building results
     - Preparation of Calibration Target Values
       - Use of Home-Interview Survey
     - Model Calibration Results (2005)
     - Model Validation Results (2005)
     - Analysis of the 2030 No-Build Forecast
       - Test Using the 2005 Transit Network for the No-Build Forecast
       - Reasonableness Evaluation
     - Status of Travel Forecasts (2030)
       - Baseline
       - Build
       - Opening Day (2017)
     - Preliminary User Benefit Results
     - Non-Included Attribute Tests
     - NHB Direct Demand Model Estimation & Application

- On-Going Improvements
  - Status of Highway Travel Time & Volume Comparisons
    - Matrix Estimation using TransCAD
- Upcoming Travel Forecasting Tasks
  - Walk to Rail Market Segmentation
  - Strategy for Route Level Capacity Restraint
  - Risk & Uncertainty Analysis
  - Air Passenger Mode Choice Model Implementation

3. Response to Scoping Comments on the Managed Lane Alternatives

- Definition of the Managed Lane Alternatives
- Managed Lane Alternatives travel forecasts
- Managed Lane Alternatives capital cost estimates

4. Next Steps in Project Development

- Preparation of Draft EIS and Conceptual Engineering to Support the EIS
- Preliminary Engineering

5. Conclusion/Status of Agenda Topics

2.0 Model Re-Calibration and Validation

2.1 Review of Previous Model Enhancements

This agenda item involved a review of model enhancements previously documented in the *Honolulu High-Capacity Transit Corridor Project Travel Forecasting Methodology Report*, June 30, 2006.

2.2 Summary of On-Board Survey Expansion

2.3 Summary of On-Board Survey Assignment Analysis

Appendix A – 2005 On-Board Survey Assignment & Analysis describes the findings related to these two topics.

2.4 Preparation of Calibration Target Values

Appendix B – 2005 Calibration Target Value Preparation describes the findings related to this topic.

2.5 Model Calibration Results (2005)

Appendix C – 2005 Calibration Results includes three pages. The first page, labeled "MC Coeff", presents initial and revised mode choice coefficients. The second page, labeled "constants", summarizes the revised set of constants developed for the 2005 model calibration. They are displayed in Table 1. It is this model (referred to as model F) that has been used to prepare forecasts for the Preliminary Engineering application. Table 2 provides a summary of the constants that were derived for the model used in the Alternatives Analysis planning (referred to as model E). The primary differences between the two calibrations are:

- Use of the 2005 on-board rider survey to develop calibration target values (refer to Appendix B);
- Correction to the representation of the Express Bus constant. In model E it was only applied to walk to Express Bus. In model F it applies to Express bus regardless of access mode;
- Calibration of the Informal Park-and-Ride constant in Model F. In model E this constant was "asserted".

Note that the constants on Express Bus are negative. Also note that Express Bus service only exists in the peak. Therefore, the constant is only computed for trip purposes which rely upon peak level-of-service matrices. The sign and magnitude of

the Express Bus constants reflect the lack of midday service, the reluctance to park-and-ride to Express Bus and the general level-of-service offered by Express Service.

Also note that the informal park-and-ride constants are positive. This reflects the fact that (1) very few transit riders drive to transit (even for auto ownership group 2+ – never more than 20% drive), (2) those that do drive are kiss-and-ride (80% or more), and (3), of those that do park-and-ride, 90 or more percent are informal park-and-riders.

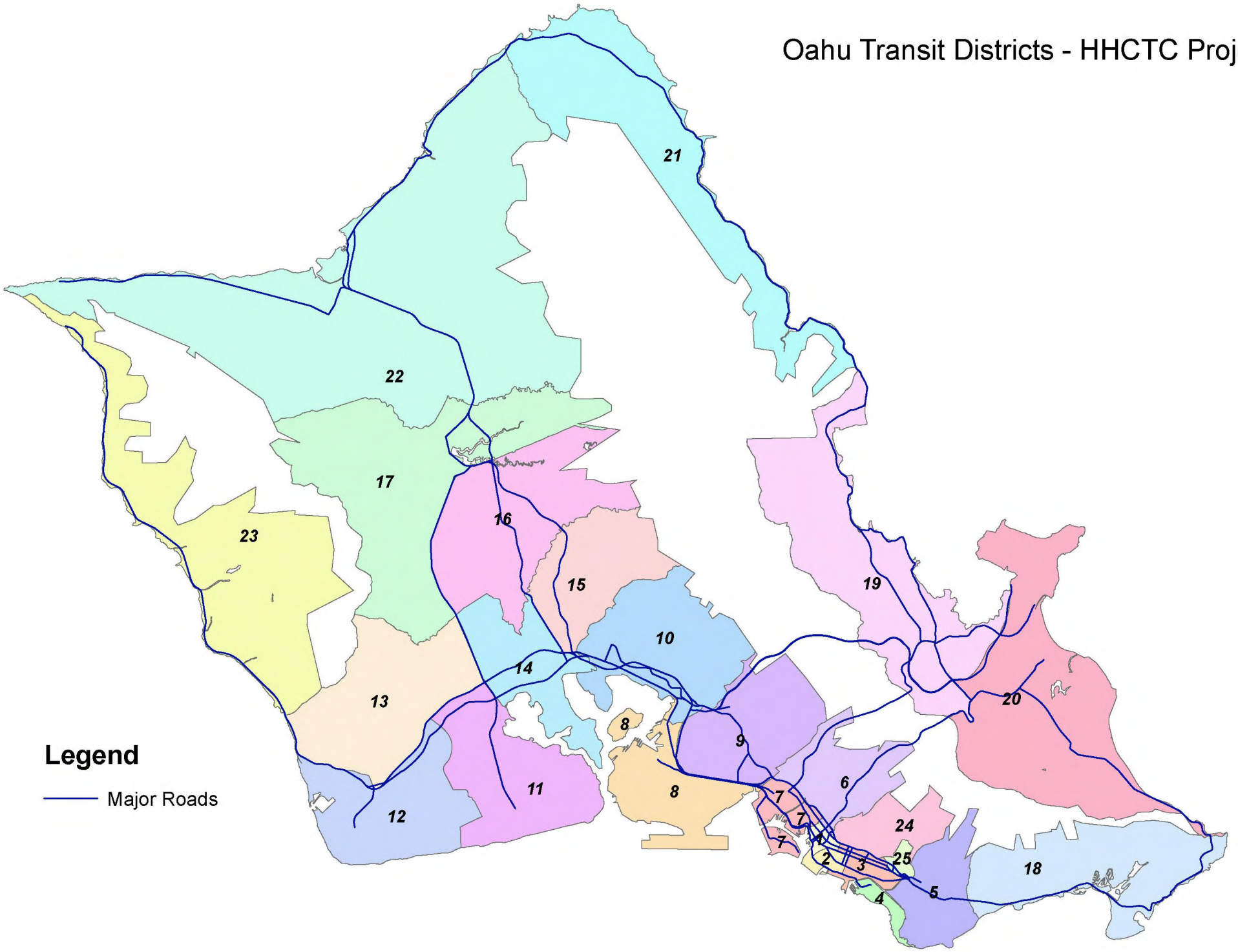
The third page in Appendix C, labeled "Trip Length Plot", compares the observed and estimated trip length for all transit trips. Although the model is slightly over-estimating trip length (7.64. v. 7.33 miles) on the average, it does appear to be over-estimating short trips at trip lengths less than 5 miles.

2.6 Model Validation Results (2005)

Appendix D – 2005 Observed & Estimated Results includes five pages, which compare observed and estimated transit trips on a district level. A district map is shown on the next page of this chapter. The first Appendix D page summarizes the observed and estimated total transit trips by district. These tabulations contain the most recent expansion of the survey (which includes "bus stop on") and the newly calibrated model. The second page summarizes the differences. Two columns are highlighted (in green and yellow respectively) that are important: under-estimation of riders to the Central Core and to the district including Ala Moana Center (districts 1 and 3). Both are attractors that the model cannot fully grasp given level-of-service attributes alone. Waikiki (district 4) is under-estimated at the production end and is highlighted in blue.

The third and fourth pages in Appendix D compare the observed transit trip tables before and after the introduction of "bus stop on" in the expansion factor computation. There are differences, but none of them appear to be unreasonable. The inclusion of "bus stop on" in the expansion factor computation addresses the non-response bias generated by those making shorter trips, and therefore, less time to fill out the questionnaire.

The fifth page compares the newly expanded observed matrix with Model E. In general, the patterns of under-estimation are identical to the new model.


Oahu Transit Districts - HHCTC Project
Legend
Major Roads
21
22
17
23
16
15
19
10
14
13
20
8
9
11
8
6
7
7
7
24
1
2
3
25
18
4
5
12

AR00064879

3.0 Travel Forecasts

3.1 Analysis of the 2030 No-Build Forecast

An analysis of the reasonableness of the 2030 No-Build forecast was undertaken. Part of the analysis was a step-wise buildup of forecasts to isolate the impact of the model inputs to the corresponding results, that is to separately look at the various factors that change between 2005 and 2030, including changes in transit service, changes in highway travel conditions, and changes in population, households and employment. In summary, about 6 percent of the growth is attributable to improvements in transit service, about 4 percent is attributable to changes (declines) in highway travel conditions, and about 90 percent is attributable to changes in population, households and employment.

The growth attributable to changes in population, households and employment is nearly identical to (very slightly less than) the change in estimated total person trips (summed across all modes) so it is correct to say that, in the aggregate, the forecast growth in transit trips tracks with overall growth in travel-making on the island. As a point of comparison, the 2005 on-board transit survey estimated average weekday unlinked trips at 236,600. Compared to 1995's 225,700 average weekday unlinked trips this represents 4.8% growth, while Honolulu County population grew 2.7% in the same period. Another comparison of the reasonableness of model results was obtained by using the 2005 model to backcast to 1995. The difference between observed (225,700) and the model estimate (223,400) was only 1%.

3.2 Status of Travel Forecasts (2030)

Appendix E – 2030 Forecast Summary includes two pages. The first provides a set of basic summaries for the recent set of forecast runs. In this summary, both boardings and linked trips are tabulated for three alternatives, No-Build, Baseline (identified as TSM in Appendix E) and the East Kapolei to Ala Moana Center via Salt Lake Build alternative (identified as MOSL in Appendix E). Results are given for the assumed opening year, 2017, and for 2030.

For 2030, the Baseline gains 10.4% more linked trips than the No-Build, while the Build alternative gains 9.8% more linked trips than the Baseline. These comparisons are nearly identical when looking at the 2017 forecasts. The guideway carries 68,000 riders in 2017 and just over 85,000 riders in 2030. If the fixed guideway line were in operation in 2005 it would carry just over 62,000 daily trips (this test is shown in gray). If the transit system included fixed guideway in 2005, it would carry 23.7% more linked trips than the existing system.

The second page in Appendix E looks at drive access to transit in more depth. Note that an increasing amount of the drive access to transit is attracted for formal locations. Given the nature of the model, as calibrated for 2005, the level of park-and-

ride seems relatively low, with kiss-and-ride correspondingly higher. A key question is whether drive access to transit behavior would change in the presence of the fixed-guideway system.

3.3 Preliminary User Benefit Results

3.4 Non-Included Attribute Tests

Appendix F – User Benefit Results includes six pages. The first page provides a summary of the user benefit results for the East Kapolei to Ala Moana Center via Salt Lake Build alternative (identified as MOSL) compared to the Baseline (identified as TSM). The summary indicates that only 4.7% of the benefits are being capped, and 99.6% of the benefits occur where fixed guideway is available in the Build alternative. For existing riders, the average user benefit per rider is 7.3 minutes and 17.1 minutes for new riders.

The lower portion of the page includes the results from considering the non-included attributes of the fixed guideway based upon the Section 3 guidelines as presented in the February 5, 2007 "Proposed Guidance on New Starts/Small Starts Policies and Procedures". The second page in Appendix F contains the level of benefits assumed for the fixed guideway alternative.

The last four pages in Appendix F are thematic plots of user benefits for the Journey to Work, Home-Based Work (JTW-HBW) purpose and total for all purposes.

3.5 NHB Direct Demand Model Estimation & Application

Appendix G – NHB Direct Demand Estimation/Application describes the findings related to this topic.

Appendix A 2005 On-Board Survey Assignment & Analysis

DATE: **Monday, May 14, 2007**

FROM: **Heather Fujioka, PB**

TO: **File**

RE: **2005 On-Board Survey Assignment & Analysis**

On-Board Survey Assignment

A new on-board survey was performed between December 2005 and January 2006. The data from this survey is being used to refine the travel demand models so as to create forecasts for future transit ridership for the Honolulu High-Capacity Transit Corridor Project.

Data were collected using an innovative methodology that included the distribution of questionnaires to boarding passengers while simultaneously recording the boarding counts using GPS-enhanced palm devices. The Palm devices with GPS recorded the location and time (arrival and departure) at each bus stop. By entering questionnaire numbers into the units prior to arrival at a bus stop, this process also tied a sequence of questionnaires directly to a bus stop. This process allowed for expanding the data by route, time of day, direction, and bus stop (on) location. Previously surveys were only expanded by route, time of day, and direction. By adding bus stop location to the expansion process, the data will be more accurately represented since certain bus stop locations along a route had higher response rates than other locations (especially longer trips, see Figure 1).

The OMPO model considers 4 transit sub-modes; walk to local, walk to premium, park and ride, and kiss and ride, and two time periods; peak and off peak. Thus 8 trip tables were constructed for the 4 sub-modes and 2 time periods and these tables were assigned to their respective networks. The assignments were then combined to produce a daily transit assignment.

The transit trip tables were assigned using the same pathbuilding procedure used for skimming (see Table 1). Table 2 shows the bus speed factors used in the model. The resulting transit boardings by class of service are shown in Table 3.

Table 4 shows the resulting transit boardings by route for the observed 2005 boardings, 2005 assigned on-board survey boardings using the OLD (route, TOD, direction) expansion factor, and the 2005 assigned on-board survey boardings using the NEW (route, TOD, direction, bus stop on location) expansion factor. The 91% R^2 in Figure 2 shows that the goodness of fit is excellent and that the transfer penalty, and path parameters are reflecting what's being observed.

Table 1. Current Model Path Building Parameters

Walk to Local/Limited Stop Bus	
Walk Speed	3 MPH
Initial wait time factor	2
In-vehicle time factor for local bus	1
In-vehicle time factor for limited stop	0.9
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes
Walk to Express Bus	
Walk Speed	3 MPH
Initial wait time factor	2
In-vehicle time factor	1.2
Bonus in-vehicle time factor for express bus	1.0
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes
Drive Access/Egress to Bus	
Walk Speed	3 MPH
Maximum Drive Time	15 minutes
Initial wait time factor	2
In-vehicle time factor	1
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes

**Note: The kiss and ride parameters were the same as the walk to local bus mode.

Table 2. Bus Speed Factors

Functional Class	Peak Factor	Off Peak Factor
Freeways / Expressways	1.0	1.0
Ramps	1.0	1.0
Arterial I	1.54	1.65
Arterial II	1.24	1.53
Arterial III	1.95	0.83
Collector I	1.22	1.50
Collector II	1.81	1.18
Local	0.83	1.41

Table 3. Transit Boardings by Class of Service

Class of Service	2005 Observed	2005 Year (OBS Assn) OLD EXPANSION FACTOR (ROUTE, TOD, DIRECTION)	2005 Year (OBS Assn) NEW EXPANSION FACTOR (ROUTE, TOD, DIRECTION, BUS STOP ON)	Percent Difference (New Expansion Factor Assignment / Observed)
Limited Stop	29,184	28,931	28,624	0.98
Urban Trunk	112,111	114,423	114,453	1.02
Suburban Trunk	62,159	56,172	56,920	0.92
Urban Feeder	12,943	8,866	9,906	0.77
Suburban Feeder	2,312	2,250	2,437	1.05
Community Circulator	9,573	7,485	7,257	0.76
Peak Express	8,291	8,568	8,008	0.97
Total	***236,573***	***226,695***	***227,605***	**0.96**

Table 4. Transit Boardings by Route Number

Class of Service	Route Number	2005 Observed	2005 Year (OBS Assn) OLD EXPANSION FACTOR (ROUTE, TOD, DIRECTION)	2005 Year (OBS Assn) NEW EXPANSION FACTOR (ROUTE, TOD, DIRECTION, BUS STOP ON)	Percent Difference (New Expansion Factor Assignment / Observed)
Limited Stop Routes					
1	A	15,429	19,183	19,782	0.83
1	B	7,443	3,629	3,264	0.64
1	C	6,312	6,119	5,578	1.09
Subtotal		*29,184*	*28,931*	*28,624*	0.84
Urban Trunk Routes					
2	1	21,096	25,996	25,127	1.07
2	2	19,863	19,254	20,424	0.93
2	3	12,435	13,928	13,943	1.03
2	4	9,827	8,042	7,687	0.68
2	5	1,557	1,492	1,383	0.92
2	6	6,635	6,669	6,247	1.54
2	8	9,254	3,827	3,707	0.37
2	9	10,121	7,053	6,795	0.70
2	13	13,423	17,024	16,972	1.15
2	19	5,357	4,883	5,347	1.00
2	20	2,543	6,255	6,821	2.60
Subtotal		*112,111*	*114,423*	*114,453*	0.98
Suburban Trunk Routes					
3	11	1,382	745	428	0.62
3	22	2,513	519	411	0.39
3	40	8,083	8,968	10,344	1.11
3	41	2,369	1,125	1,098	0.50
3	42	10,824	8,888	8,811	0.89
3	43	2,806	2,101	2,072	1.74
3	52	4,826	4,258	4,592	1.24
3	53	3,701	2,288	2,692	0.79
3	54	4,542	1,738	1,859	1.23
3	55	3,835	4,080	4,143	0.96
3	56	3,198	3,658	3,405	1.00
3	57	4,345	4,703	4,860	1.02
3	58	2,650	5,124	4,305	1.87
3	62	5,099	5,619	5,504	1.23
3	65	1,987	2,358	2,396	1.34
Subtotal		*62,159*	*56,172*	*56,920*	1.07

Urban Feeder					
4	7	3,929	3,552	4,326	1.13
4	10	692	226	395	0.92
4	14	1,823	2,110	2,508	1.42
4	15	928	575	425	0.86
4	16		61	95	
4	17	1,482	449	443	0.35
4	18	735	216	215	1.44
4	21	65	2	1	6.15
4	31	642	336	270	0.50
4	32	2,647	1,339	1,228	0.57
Subtotal		*12,943*	*8,866*	*9,906*	0.95
Suburban Feeder					
5	70	253	513	521	2.55
5	71		118	185	
5	72	494	463	332	0.83
5	73	870	621	836	0.53
5	74		82	77	
5	76	469	329	379	0.83
5	77	225	124	107	1.79
Subtotal		*2,312*	*2,250*	*2,437*	1.14
Community Circulator					
6	401	332	527	348	1.20
6	402	195	633	557	2.50
6	403	526	153	119	0.49
6	411	805	455	369	0.09
6	412	456	467	536	1.10
6	413	190	132	167	0.78
6	414		134	103	
6	415		28	21	
6	421	484	234	227	0.70
6	431	521	75	43	1.28
6	432	3,145	578	592	0.16
6	433	1,043	1,405	1,220	1.57
6	434	1,876	2,664	2,955	1.46
6	503		-	-	
Subtotal		*9,573*	*7,485*	*7,257*	0.88

Peak Express					
7	80	317	503	370	0.65
7	81	1,312	918	853	0.54
7	82		26	13	
7	83	593	1,026	1,230	1.38
7	84	485	548	480	1.02
7	85	460	55	44	0.28
7	86	18	53	20	1.00
7	88	336	269	224	0.72
7	89		41	65	
7	90	114	232	214	1.69
7	91	975	862	791	0.72
7	92	240	273	245	0.75
7	93	1,153	959	736	0.55
7	95		-	-	
7	96	156	127	128	0.78
7	97	408	575	601	0.89
7	98	210	9	20	0.30
7	101	405	608	589	0.94
7	102	180	203	158	0.99
7	103		82	86	
7	201	543	766	795	1.20
7	202	258	230	245	0.90
7	203	129	203	101	0.07
Subtotal		*8,291*	*8,568*	*8,008*	0.79
Grand Total		***236,573***	***226,695***	***227,605***	***0.98***

Figure 1. Trip Length Frequency Histogram Difference between New & Old Expansion Factor

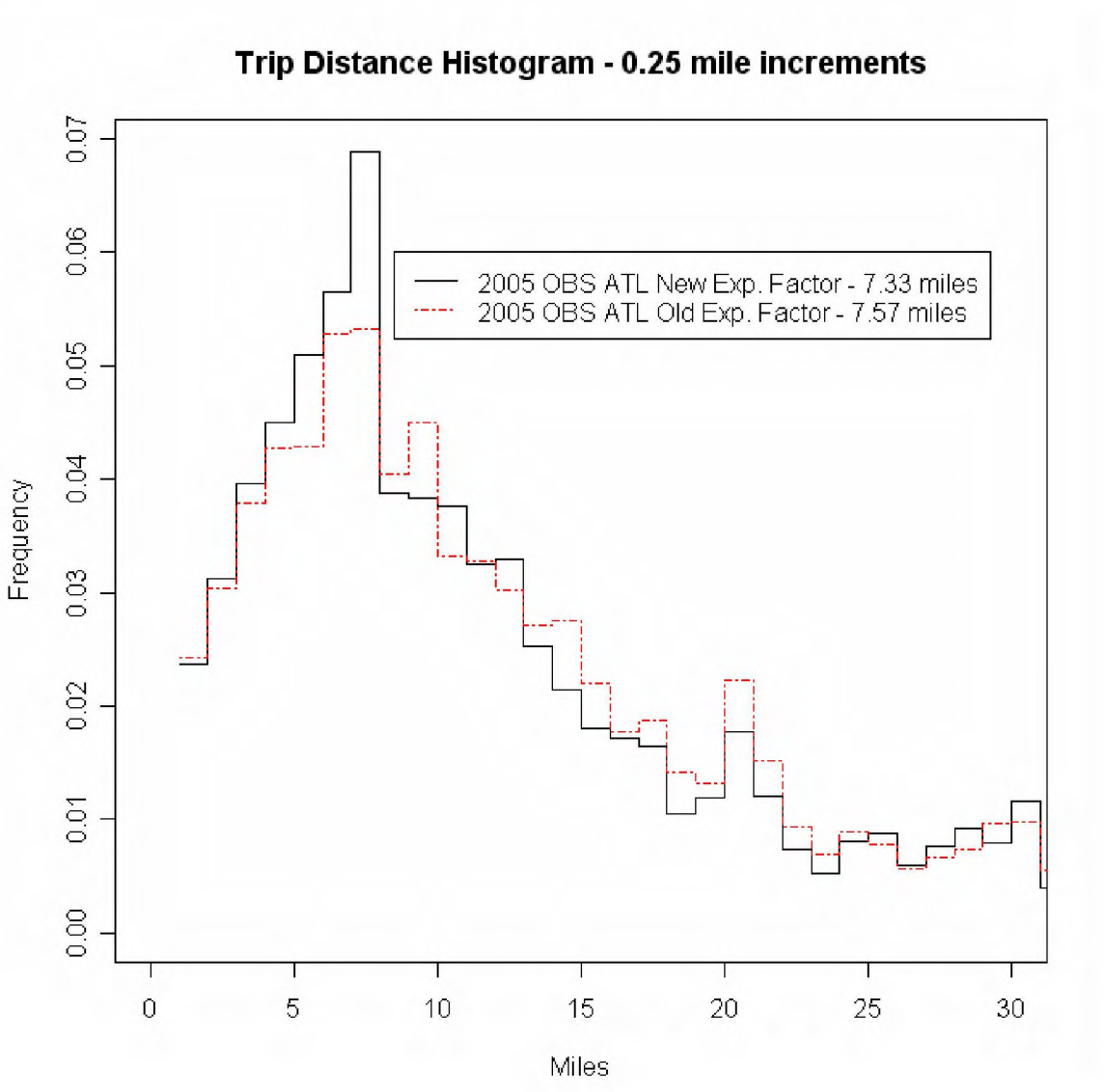
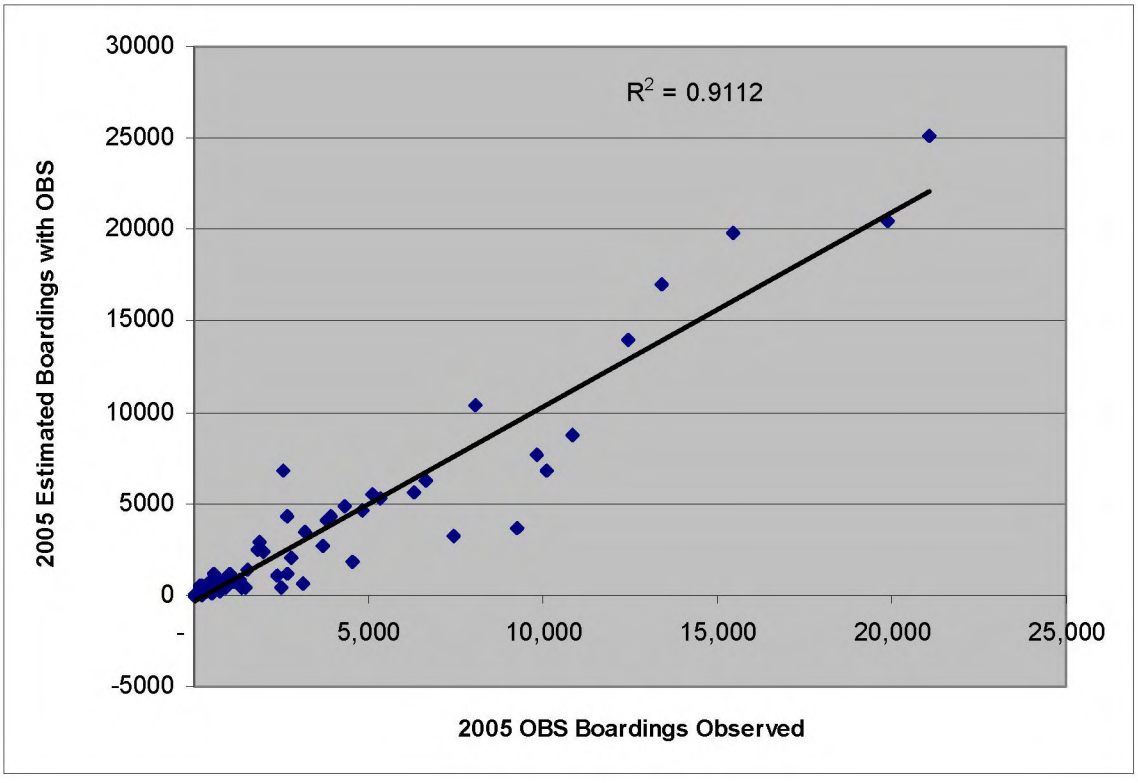


Figure 2. 2005 Observed Boardings and 2005 Estimated Boardings with On Board Survey Data for each Route



Appendix B 2005 Calibration Target Value Preparation

DATE: **Tuesday, May 15, 2007**

FROM: **Heather Fujioka, PB**

TO: **File**

RE: **2005 Calibration Target Value Preparation**

Calibration Target Values

The new calibration year is 2005. The 2005 person trip control totals were derived from a model run for 2005 done on September 5, 2006. The relative proportions between auto and auxiliary from the 1995 Home Interview Survey (HIS) were used to obtain the 2005 values for auto and auxiliary. And the shares for transit are computed based upon the 2005 On-Board Survey. Table 1 shows the shares that were used in the calibrated model for the Honolulu AA project in the fall/winter of 2006. Table 2 shows the shares that were used to calibrate to the year 2005 for the May 2006 submittal to FTA for entry into preliminary engineering.

Since it was not possible to directly obtain the same trip purposes from the 2005 on-board survey as the 1995 Home-interview survey (and the model definitions), the home-interview survey proportions of transit trips for the JTW-WB, JTW-NB, JAW-WB, JAW-NB, and NWR-NHB were used to proportion the non-home based trip purposes from the on-board survey.

Also the Home-interview survey transit trip proportions for JTW-HBNW, NWR-HBShp, NWR-HBOth were used to proportion out the Home-based shop, and home-based other trip purposes from the on-board survey. And finally, the on-board survey shows that of the trips that were designated as park and ride, a large proportion of those trips were at informal locations. So another variable was added at the bottom of Table 2 that shows that proportion of park and ride trips that were at informal locations.

A final version of the calibration target values is currently being developed that relies upon time period and work status of the trip maker to more accurately determine the appropriate placement of the trip into model defined categories.

Table 1. Observed Shares from Winter 2006 Calibration (1995 Calibration Year)

Purpose >	Journey To/From Work (JTW)				Journey At Work (JAW)		Non-Work Related (NWR)				
Share \/	HBW	HBNW	WB	NB	WB	NB	HBK12	HBCol	HBShp	HBOth	NHB
Auto-Ownership/Level 1 Mode											
S0Hwy	0.14	0.14					0.05	-	0.20	0.15	
S0Trn	0.65	0.42					0.20	0.73	0.37	0.38	
S0Aux	0.22	0.45					0.75	0.27	0.43	0.47	
S1Hwy	0.67	0.91	0.86	0.93	0.72	0.81	0.53	0.59	0.84	0.81	0.85
S1Trn	0.21	0.05	0.06	0.03	0.03	-	0.11	0.30	0.06	0.06	0.06
S1Aux	0.12	0.04	0.07	0.04	0.26	0.19	0.36	0.10	0.10	0.13	0.10
S2Hwy	0.89	0.97					0.73	0.75	0.96	0.90	
S2Trn	0.08	0.01					0.10	0.16	0.02	0.03	
S2Aux	0.03	0.02					0.17	0.09	0.02	0.07	
Level 2- Highway Shared Ride											
S1o1	0.66	0.39	0.74	0.37	0.74	0.58	0.01	0.64	0.31	0.33	0.25
S1sr	0.34	0.61	0.26	0.64	0.26	0.42	0.99	0.36	0.70	0.67	0.75
S2o1	0.81	0.42	--	--	--	--	0.06	0.82	0.38	0.34	--
S2sr	0.19	0.58	--	--	--	--	0.94	0.19	0.62	0.67	--
Level 3- Highway Shared Ride Occupancy											
Socc2	0.81	0.62	0.79	0.68	0.72	0.80	0.38	0.77	0.58	0.55	0.52
Socc3	0.19	0.38	0.21	0.32	0.28	0.20	0.62	0.23	0.43	0.45	0.48
Level 2- Transit Access											
S0wacc	0.99	0.99	--	--	--	--	0.93	0.99	0.99	0.99	--
S0dacc	0.01	0.01	--	--	--	--	0.07	0.01	0.01	0.01	--
S1wacc	0.96	0.95	0.82	0.99	0.92	0.99	1.00	0.99	0.98	0.98	0.97
S1dacc	0.05	0.05	0.18	0.01	0.08	0.01	0.00	0.01	0.02	0.02	0.03
S2wacc	0.85	0.99	--	--	--	--	0.85	0.96	0.91	0.97	--
S2dacc	0.15	0.01	--	--	--	--	0.16	0.04	0.10	0.03	--
Level 3 Mode – Drive Access											
PNR	0.34	0.30	0.19	0.19	0.19	0.19	0.30	0.30	0.30	0.30	0.19
KNR	0.66	0.70	0.81	0.81	0.81	0.81	0.70	0.70	0.70	0.70	0.81
Level 2- Auxiliary Path											
Sauxw	0.79	0.92	0.94	0.99	0.96	0.99	0.93	0.63	0.92	0.91	0.95
Sauxb	0.21	0.08	0.06	0.01	0.04	0.01	0.07	0.37	0.08	0.09	0.05

Notes: 1) Purposes not based at home are not stratified by vehicle ownership—S1 shares apply across all vehicle-ownership strata. 2) "--"indicates cell not applicable.

Tables 1 and 2's Key

S0, S1, S2 = Shares for Households with 0 cars, 1 car, and 2 car respectively
CBD = Attraction End of Trip is in Central Business District
OTH = Attraction End of Trip is in Core Commercial and Core Residential area.
ELS = Attraction End of Trip is in Urban, Suburban, or Rural area.
HWY = Mode is Auto in Level 1 of the Mode Choice Model.
TRN = Mode is Transit in Level 1 of the Mode Choice Model.
AUX = Mode is Non-motorized in Level 1 of the Mode choice Model.
O1 = Mode is Drive alone in Level 2 of the Mode Choice Model.
SR = Mode is Shared Ride in Level 2 of the Mode Choice Model.
OCC2 = Mode is Shared Ride 2-Persons in Level 3 of the Mode Choice Model.
OCC3 = Mode is Shared Ride 3 or more persons in Level 3 of the Mode Choice Model
WACC = Mode is Walk Access to Transit in Level 2 of the Mode Choice Model.
DACC = Mode is Drive Access to Transit in Level 2 of the Mode Choice Model.
NGDWY = Mode is walk access to Local Bus in Level 3 of the Mode Choice Model.
GDWY = Mode is walk access to guideway in Level 3 of the Mode Choice Model.
PREM = Mode is walk access to premium bus in Level 3 of the Mode Choice Model.
PNR = Mode is Park and Ride in Level 3 of the Mode Choice Model.
KNR = Mode is Kiss and Ride in Level 3 of the Mode Choice Model.
AUXW = Mode is Walk in Level 2 of the Mode Choice Model.
AUXB = Mode is Bike in Level 2 of the Mode Choice Model.

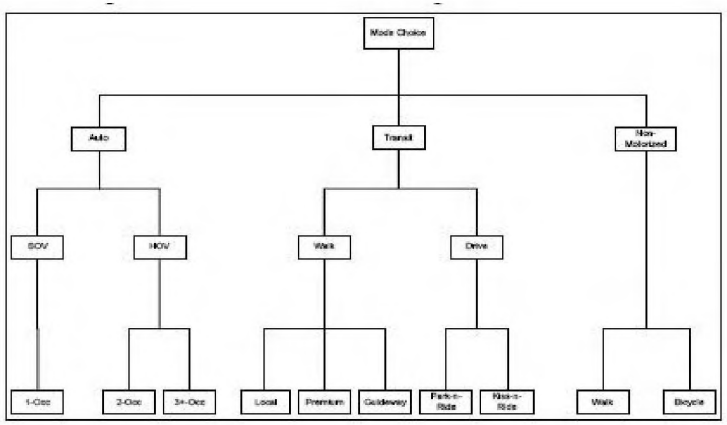
Table 2. Observed Shares for 2005 Calibration Year

Purpose >	Journey To/From Work (JTW)				Journey At Work (JAW)		Non-Work Related (NWR)				
Share \/	HBW	HBNW	WB	NB	WB	NB	HBK12	HBCol	HBShp	HBOth	NHB
Auto-Ownership/Level 1 Mode											
S0Hwy	0.138	0.268					0.125	0.010	0.220	0.163	
S0Trn	0.648	0.282					0.225	0.850	0.294	0.327	
S0Aux	0.215	0.450					0.650	0.140	0.486	0.509	
S1Hwy	0.725	0.932	0.871	0.941	0.720	0.810	0.553	0.707	0.864	0.836	0.867
S1Trn	0.151	0.025	0.058	0.018	0.020	-	0.075	0.169	0.037	0.034	0.031
S1Aux	0.124	0.043	0.071	0.040	0.260	0.190	0.372	0.124	0.099	0.130	0.102
S2Hwy	0.899	0.975					0.765	0.750	0.969	0.912	
S2Trn	0.068	0.009					0.057	0.160	0.012	0.017	
S2Aux	0.033	0.017					0.178	0.090	0.019	0.071	
Level 2- Highway Shared Ride											
S1o1	0.659	0.387	0.745	0.367	0.736	0.579	0.007	0.638	0.305	0.327	0.250
S1sr	0.341	0.613	0.255	0.633	0.264	0.421	0.993	0.362	0.695	0.673	0.750
S2o1	0.806	0.420	--	--	--	--	0.061	0.815	0.382	0.335	--
S2sr	0.194	0.580	--	--	--	--	0.939	0.185	0.618	0.665	--
Level 3- Highway Shared Ride Occupancy											
Socc2	0.81	0.62	0.79	0.68	0.72	0.8	0.38	0.77	0.58	0.55	0.52
Socc3	0.19	0.38	0.21	0.32	0.28	0.2	0.62	0.23	0.43	0.45	0.48
Level 2- Transit Access											
S0wacc	0.979	0.965	--	--	--	--	0.972	0.991	0.965	0.965	--
S0dacc	0.021	0.035	--	--	--	--	0.028	0.009	0.035	0.035	--
S1wacc	0.919	0.895	0.826	0.99	0.869	0.99	0.935	0.919	0.952	0.964	0.851
S1dacc	0.081	0.105	0.174	0.01	0.131	0.01	0.065	0.081	0.048	0.036	0.149
S2wacc	0.786	0.996	--	--	--	--	0.907	0.899	0.758	0.919	--
S2dacc	0.214	0.004	--	--	--	--	0.093	0.101	0.242	0.081	--
Level 3 – Transit WALK/DRIVE Path											
Sngdwy	0.898	0.977	0.977	1.000	0.983	1.000	0.972	0.959	0.963	1.000	1.000
Sprem	0.102	0.023	0.023	-	0.017	-	0.028	0.041	0.037	0.000	-
Sgdwy	0	0	0	0	0	0	0	0	0	0	0
Level 3 Mode – Drive Access											
PNR	0.218	0.15	0.01	0.01	0.152	0.01	0.213	0.277	0.01	0.01	0.01
KNR	0.782	0.85	0.99	0.99	0.848	0.99	0.787	0.723	0.99	0.99	0.99
Level 3 Mode – Transit DRIVE Path by Auto-Ownership											
S1Pnr	0.337	0.2	0.01	0.01	0.152	0.01	0.138	0.000	0.01	0.01	0.01
S1Knr	0.663	0.8	0.99	0.99	0.848	0.99	0.862	1.000	0.99	0.99	0.99
S2Pnr	0.184	0.1	--	--	--	--	0.246	0.290	0.01	0.01	--
S2Knr	0.816	0.9	--	--	--	--	0.754	0.710	0.99	0.99	--
Level 2- Auxiliary Path											
Sauxw	0.791	0.850	0.936	0.990	0.962	0.99	0.900	0.540	0.922	0.909	0.952
Sauxb	0.209	0.150	0.064	0.010	0.038	0.01	0.100	0.460	0.078	0.091	0.048
Informal Park and Ride											
Sinfl	0.9	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Appendix C 2005 Calibration Results

MC Coeff

	Purpose	Journey To/From Work (JTW)				Journey At Work (JAW)		Non-Work Related (NWR)				
Existing	Coefficient	HBW	HBNW	WB	NB	WB	NB	HBK12	HBCol	HBShp	HBOth	NHB
	Generic											
	In-vehicle Time	-0.0185	-0.0185	-0.0185	-0.0185	-0.0181	-0.0181	-0.0110	-0.0185	-0.0181	-0.0181	-0.0181
	Walk time	-0.0370	-0.0370	-0.0370	-0.0370	-0.0362	-0.0362	-0.0220	-0.0370	-0.0362	-0.0362	-0.0362
	Wait time	-0.0318	-0.0318	-0.0318	-0.0318	-0.0362	-0.0362	-0.0185	-0.0318	-0.0362	-0.0362	-0.0362
	Cost	-0.0031	-0.0031	-0.0031	-0.0031	-0.0449	-0.0449	-0.0040	-0.0031	-0.0449	-0.0449	-0.0449
	Transfers	-0.0918	-0.0918	-0.0918	-0.0918	-0.2172	-0.2172	-0.1110	-0.0918	-0.2172	-0.2172	-0.2172
	Nesting Coefficient											
	Access	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447
	Path	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447
	Lot	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Auto	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	Occupancy	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Auxiliary	1	1	1	1	1	1	1	1	1	1	1



	Purpose	Journey To/From Work (JTW)				Journey At Work (JAW)		Non-Work Related (NWR)				
Variable Relationships	Coefficient	HBW	HBNW	WB	NB	WB	NB	HBK12	HBCol	HBShp	HBOth	NHB
	Generic											
	In-vehicle Time	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	Walk time	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000
	Wait time	3.4378	3.4378	3.4378	3.4378	4.0000	4.0000	3.3636	3.4378	4.0000	4.0000	4.0000
	Cost	0.1676	0.1676	0.1676	0.1676	2.4807	2.4807	0.3636	0.1676	2.4807	2.4807	2.4807
	Transfers	4.9622	4.9622	4.9622	4.9622	12.0000	12.0000	10.0909	4.9622	12.0000	12.0000	12.0000
		$3.58	$3.58	$3.58	$3.58	$0.24	$0.24	$1.65	$3.58	$0.24	$0.24	$0.24
Proposed Values	**Generic**											
	In-vehicle Time	-0.0250	-0.0250	-0.0250	-0.0250	-0.0200	-0.0200	-0.0100	-0.0250	-0.0100	-0.0100	-0.0100
	Walk time	-0.0500	-0.0500	-0.0500	-0.0500	-0.0400	-0.0400	-0.0200	-0.0500	-0.0200	-0.0200	-0.0200
	1st Wait <5	-0.0500	-0.0500	-0.0500	-0.0500	-0.0400	-0.0400	-0.0200	-0.0500	-0.0200	-0.0200	-0.0200
	1st Wait >5	-0.0250	-0.0250	-0.0250	-0.0250	-0.0200	-0.0200	-0.0100	-0.0250	-0.0100	-0.0100	-0.0100
	Transfer Wait	-0.0500	-0.0500	-0.0500	-0.0500	-0.0400	-0.0400	-0.0200	-0.0500	-0.0200	-0.0200	-0.0200
	Cost	-0.0042	-0.0042	-0.0042	-0.0042	-0.0050	-0.0050	-0.0084	-0.0042	-0.0084	-0.0084	-0.0084
	Transfers	-0.1241	-0.1241	-0.1241	-0.1241	-0.2400	-0.2400	-0.1200	-0.1241	-0.1200	-0.1200	-0.1200
	Nesting Coefficient											
	Access	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Path	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Lot	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Auto	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Occupancy	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Auxiliary	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Toll	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Value Of Time	$3.58	$3.58	$3.58	$3.58	$2.39	$2.39	$0.72	$3.58	$0.72	$0.72	$0.72

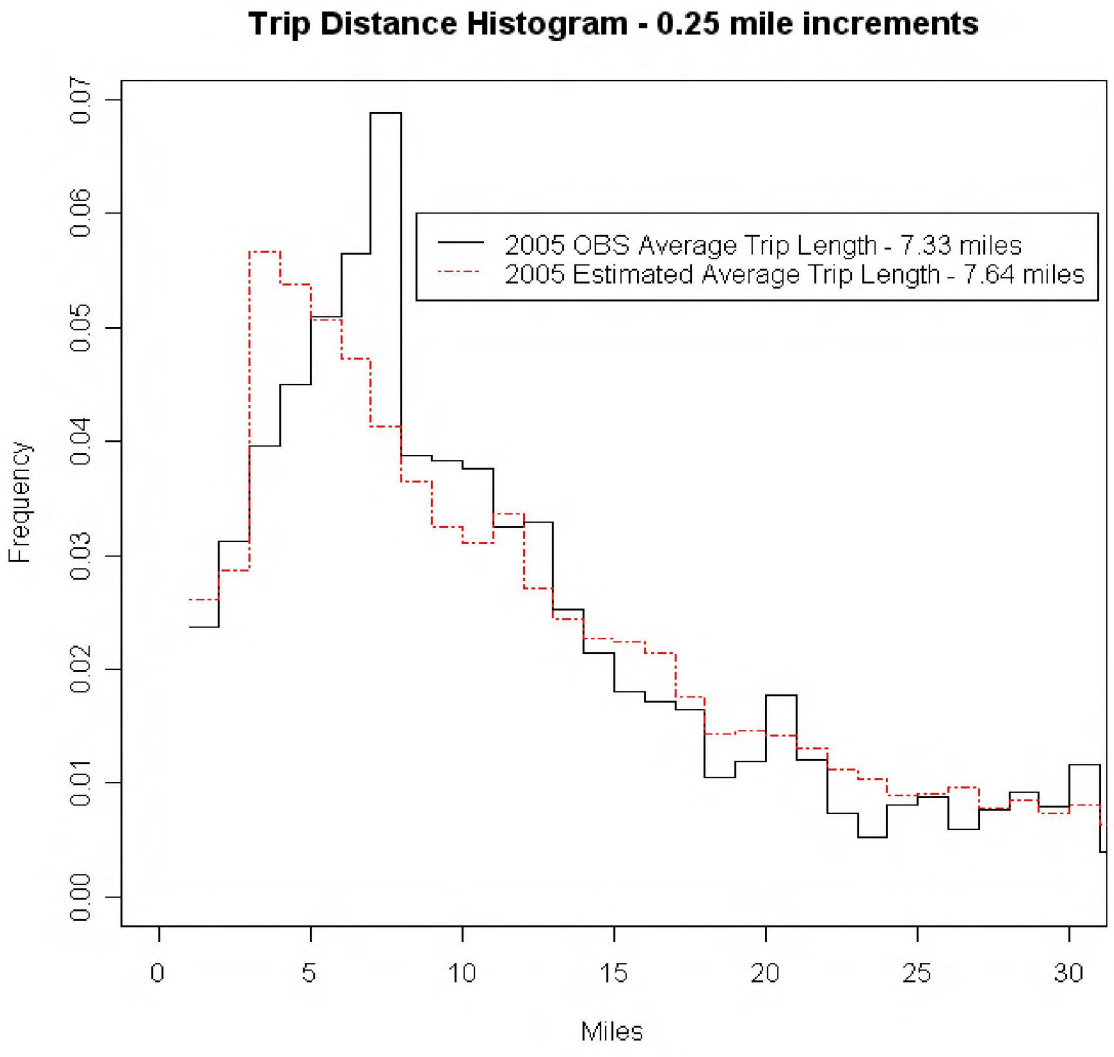
Non-Work Cost Coefficient=2*Home-Based Work; NHB Cost Coefficient=0.6*Non Work

Walk & Drive To Transit
Walk Access to Transit (local, express, guideway)
Drive Access to Transit (pnr & knr)
Drive Alone & Shared Ride
2 & 3+ Person Auto
Walk & Bike
Toll & non-toll

Constants

Constants														
			wh	wo	ww	wn	aw	an	nk	nc	ns	no	nn	
Table 1: New Calibrated Constants, with Model Structural Changes, with new nests and long wait coeff, set to match actual transit totals, auto exp util corrected, fixed IZ shares, 7/11 recalib														
Description		Keyword	JTW-HBW	JTW-NW	JTW-WB	JTW-NB	JAW-WB	JAW-NB	NWR-K12	NWR-C	NWR-HBSH	NWR-HBO	NWR-NHB	
3+Occupancy		Kocc3	-3.241	-1.287	-2.743	-1.69	-1.583	-2.265	0.279	-2.891	-0.492	-0.334	-0.169	
1-Auto Shared Ride		K1sr	-0.840	-0.047	-1.111	0.057	-0.781	0.038	2.799	-0.880	0.382	0.287	0.592	
2+ Auto Shared Ride		K2sr	-1.432	-0.158					1.299	-1.530	0.133	0.262		
Fixed Guideway		Kgdwy												
Premium (Express) Transit		Kprem	-0.856	-1.566	-0.474				-1.119	-1.804				
1 Auto KNR		K1Knr	0.738	1.095	3.965	4.186	4.592	2.943	2.265	3.342	3.134	3.083	3.078	
2+ Auto KNR		K2Knr	1.195	1.124					1.891	1.970	3.119	3.095		
INFORMAL Park and Ride		KPKnr	1.308	2.022	2.278	3.049	2.661	2.41	2.559	1.808	2.238	2.156	2.125	
0-Auto Drive Access (all KNR)		K0dacc	-2.647	-2.166	-4.225	-6.451	-2.793	-5.259	-2.519	-3.627	-2.086	-2.385	-3.783	
1 Auto Drive Access		K1dacc	-2.115	-3.745					-3.76	-4.344	-4.967	-5.176		
2+ Auto Drive Access		K2dacc	-1.709	-7.217					-3.216	-3.059	-3.723	-4.700		
Bike share of NM		Kauxb	-3.311	-6.438	-3.656	-4.791	-3.588	-4.692	-7.744	-6.884	-4.321	-6.251	-3.22	
0 Auto Transit		K0Trn	3.513	1.820	-1.760	-2.215	-2.815	-2.601	2.455	4.288	2.185	2.617	-1.293	
1 Auto Transit		K1Trn	-0.201	-2.067					2.079	0.286	-1.235	-1.334		
2+ Auto Transit		K2Trn	-1.470	-2.824					-0.018	0.145	-2.742	-2.108		
0 Auto Non-Motorized		K0Aux	5.315	7.903	-0.034	-0.832	0.874	0.643	12.043	8.513	3.756	8.821	-0.285	
1 Auto Non-Motorized		K1Aux	2.027	-0.711					9.148	6.303	0.602	1.272		
2+ Auto Non-Motorized		K2Aux	-0.047	-2.554					2.127	6.764	-2.705	0.332		
Table 2: New Calibrated Constants, with Model Structural Changes, with new nests and long wait coeff, set to match actual transit totals, auto exp util corrected, fixed IZ shares, 7/11 recalib, Lowered Targets, KPKNR for ns														
Description		Keyword	JTW-HBW	JTW-NW	JTW-WB	JTW-NB	JAW-WB	JAW-NB	NWR-K12	NWR-C	NWR-HBSH	NWR-HBO	NWR-NHB	
3+Occupancy		Kocc3	-3.239	-1.328	-2.742	-1.678	-1.572	-2.269	0.317	-2.899	-0.493	-0.332	-0.162	
1-Auto Shared Ride		K1sr	-0.844	-0.059	-1.089	0.066	-0.796	-0.067	2.823	-0.888	0.382	0.287	0.597	
2+ Auto Shared Ride		K2sr	-1.444	-0.179					1.304	-1.538	0.135	0.262		
Fixed Guideway		Kgdwy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Express Walk Access Transit		Kprem	-0.737	-1.701					-0.865	-1.640	-0.989	-1.081		Applied Only to Walk Access To Express
1 Auto KNR		K1Knr	-0.727	-0.486	-0.378	-1.416	-0.351	0.058	-0.100	-0.896	-0.524	-0.530	-0.042	
2+ Auto KNR		K2Knr	-0.744	-1.016					-0.057	-0.285	-1.041	-1.042		
INFORMAL Park and Ride		KPKnr	-1.000	-1.000	-1.000	-10.000	-1.000	-0.500	-1.000	-1.000	-1.000	-1.000	-1.000	Asserted, Not Calibrated
0-Auto Drive Access (all KNR)		K0dacc	-2.418	-1.319	-0.263	1.573	0.897	0.160	-0.945	-1.347	-1.421	-2.290	-0.338	
1 Auto Drive Access		K1dacc	-0.084	-0.342					-1.153	-0.775	0.918	-0.661		
2+ Auto Drive Access		K2dacc	0.451	0.301					-0.026	-0.676	3.371	0.174		
Bike share of NM		Kauxb	-3.357	-24.190	-3.472	-4.743	-3.407	-4.458	-11.725	-8.187	-3.615	-5.143	-3.130	
0 Auto Transit		K0Trn	2.259	1.470	-2.285	-2.331	-2.795	-2.875	22.651	7.237	1.873	2.622	-0.512	
1 Auto Transit		K1Trn	-0.029	-1.715					2.239	0.753	-0.798	-0.899		
2+ Auto Transit		K2Trn	-1.606	-2.937					0.197	-0.235	-3.253	-1.937		
0 Auto Non-Motorized		K0Aux	3.983	24.633	-0.357	-0.894	0.565	0.223	37.871	13.310	1.838	7.413	-0.442	
1 Auto Non-Motorized		K1Aux	1.913	-0.819					11.234	6.629	0.374	1.257		
2+ Auto Non-Motorized		K2Aux	-0.001	-1.650					2.093	7.699	-2.298	0.613		
Table 3: [Table 1 - Table 2]														
Description		Keyword	JTW-HBW	JTW-NW	JTW-WB	JTW-NB	JAW-WB	JAW-NB	NWR-K12	NWR-C	NWR-HBSH	NWR-HBO	NWR-NHB	
3+Occupancy		Kocc3	(0.002)	0.041	(0.001)	(0.012)	(0.011)	0.004	(0.038)	0.008	0.001	(0.002)	(0.007)	
1-Auto Shared Ride		K1sr	0.004	0.012	(0.001)	(0.001)	(0.001)	(0.001)	(0.024)	0.008	0.000	0.000	(0.001)	
2+ Auto Shared Ride		K2sr	0.012	0.021					(0.005)	0.008	(0.002)	0.000		
Fixed Guideway														
Express Walk Access Transit		Kprem	(0.119)	0.135	(1.566)	(0.474)	0.000	0.000	(0.254)	(0.164)	0.989	1.081	0.000	
1 Auto KNR		K1Knr	1.465	1.581	4.343	5.602	4.943	2.885	2.365	4.238	3.658	3.613	3.120	
2+ Auto KNR		K2Knr	1.939	2.140					1.948	2.255	4.160	4.137		
KNR constant for PNR opportunities		KPKnr	2.308	3.022	3.278	13.049	3.661	2.910	3.559	2.808	3.238	3.156	3.125	
0-Auto Drive Access (all KNR)		K0dacc	(0.229)	(0.847)	0.525	0.116	(0.020)	0.274	(1.574)	(2.280)	(0.665)	(0.095)	(0.781)	
1 Auto Drive Access		K1dacc	(2.031)	(3.403)					(2.607)	(3.569)	(5.885)	(4.515)		
2+ Auto Drive Access		K2dacc	(2.160)	(7.518)					(3.190)	(2.383)	(7.094)	(4.874)		
Bike share of NM		Kauxb	0.046	17.752	(0.184)	(0.048)	(0.181)	(0.234)	3.981	1.303	(0.706)	(1.108)	(0.090)	
0 Auto Transit		K0Trn	1.254	0.350	0.525	0.116	(0.020)	0.274	(20.196)	(2.949)	0.312	(0.005)	(0.781)	
1 Auto Transit		K1Trn	(0.172)	(0.352)					(0.160)	(0.467)	(0.437)	(0.435)		
2+ Auto Transit		K2Trn	0.136	0.113					(0.215)	0.380	0.511	(0.171)		
0 Auto Non-Motorized		K0Aux	1.332	(16.730)	0.323	0.062	0.309	0.420	(25.828)	(4.797)	1.918	1.408	0.157	
1 Auto Non-Motorized		K1Aux	0.114	0.108					(2.086)	(0.326)	0.228	0.015		
2+ Auto Non-Motorized		K2Aux	(0.046)	(0.904)					0.034	(0.935)	(0.407)	(0.281)		

Trip Length Plot



Appendix D 2005 Observed & Estimated Results

Newly Expanded 2005 On-Board Survey using Route, Time of Day, Direction, and Bus Stop Location

Attraction District

Production District	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala-Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapuna-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawā-Whitmore-Schofield	18. East Honolulu	19. Kāne'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimanalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Mānoa - Tantalus	25. University	total
1. Ward-Chinatown	1,080	1,196	2,689	630	787	281	332	440	120	370	33	24	6	170	3	11	15	54	22	46	8	13	58	109	381	8,879
2. Kaka 'ako	329	19	476	124	158	117	231	22	33	17					5	5							6	47	109	1,699
3. Punchbowl-Sheridan-Date	6,718	841	2,068	1,110	851	607	872	589	146	993	14	65	2	262		14	5	524	223	218	18	20	61	177	1,153	17,547
4. Waikiki	6,755	1,028	8,689	1,339	2,518	421	865	1,230	169	388	14	123		543		21	63	995	222	462	99	181	50	169	1,548	27,894
5. Kahala- Tantalus	1,783	742	2,522	1,221	2,269	256	481	204	76	134	44	0	4	107		3		356	45	160	9	4	5	82	1,097	11,604
6. Pauoa-Kalihi	3,098	1,959	2,880	1,508	626	2,164	2,111	484	494	279	114	89	11	298	3	10	31	24	73	257	5	28	21	281	531	17,381
7. Iwilei-Mapunapuna-Airport	1,647	589	2,406	905	264	411	778	163	274	266	9	236	11	71	7	2	94	112	34	31		57	11	258	287	8,921
8. Hickam-Pearl Harbor	286	11	483	327	202	161	72	462	52	135	31	12		261			4	2	2				4	0	24	2,530
9. Moanalua-Halawa	1,472	1,133	987	333	177	216	711	107	885	749	5	12		112	0		8	43	8	5		14		51	209	7,237
10. 'Aiea-Pearl City	1,781	288	1,608	404	238	109	409	260	451	1,804	6	55	31	486	2	39	32	43	85	24		30	248	29	380	8,840
11. Honouliuli - 'Ewa Beach	879	136	499	441	146	297	271	208	75	619	356	238	4	1,138	18	46	19	2	27	13		120	117	39	106	5,814
12. Kapolei-Ko 'Olina - Kalaeloa	215	48	337	48	31	12	35	38	79	70	25	321	17	172			78	4	11	0	1	4	72	3	37	1,659
13. Makakilo - Makaiwa	265	20	117	15	7	31	66	35	96	91	60	617	18	100		1			0	6		5	49	2	45	1,646
14. Waipahu - Waikele - Kunia	1,800	197	1,212	1,042	69	284	698	336	227	1,063	153	235	33	3,070	37	12	7	7	3	12	12	1,029	166	34	257	11,995
15. Waiawa-Koa Ridge	376	49	27	23	25	19	63	46	9	46		215		138		4						5	5	6	8	1,065
16. Mililani - Melemanu-Kipapa	679	142	223	53	40	19	134	33	90	94	3	24		59	74	53	92		7		30	28		20	95	1,992
17. Wahiawā-Whitmore-Schofield	370	103	758	11	2	24	193	78	73	161	7	30	19	145	4	250	580	52	12	47	1	161	8	9	17	3,114
18. East Honolulu	736	109	1,249	296	781	72	135	70	76	5				19			2	1,190	1	41		14		16	220	5,032
19. Kāne'ohe - Kahalu'u - Kualoa	748	173	462	294	52	100	97	18	42	37		36		3	2	25	3	25	888	232	124	9	126	20	142	3,659
20. Kailua - Mokapu-Waimānalo	1,173	52	505	195	249	72	235	58	78	20		11	9	4		0		131	587	885	1	3	2	114	110	4,492
21. Ko'olauloa	130	192	325	5	7	15	2	9	9	6				1		7	5		326	39	384	384			23	1,868
22. North Shore	51	16	113	50	20	3	15	17	4	36	4	8		140	40	145	249	11	118		188	207	2		17	1,456
23. Wai'anae Coast	984	153	365	248	115	282	255	452	257	592	182	474	9	372	6	6	4		4	20	21	75	2,252	22	21	7,171
24. Mānoa - Tantalus	3,874	197	3,598	717	317	241	513	159	153	254	13	28	6	152			8	91	34	83		66	3	386	846	11,740
25. University	614	183	793	229	217	54	242	14	6	97		2	7	200			0	18	23	39		18		104	26	2,887
Total	37,842	9,576	35,392	11,569	10,168	6,268	9,818	5,531	3,972	8,327	1,072	2,856	186	8,022	201	654	1,300	3,685	2,754	2,622	901	2,477	3,265	1,979	7,686	178,121

2005 Model 4/23/07 Total Daily Transit Trips P to A format

Attraction

Production District	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala-Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapuna-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawā-Whitmore-Schofield	18. East Honolulu	19. Kāne'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimānalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Mānoa - Tantalus	25. University	total
1. Ward-Chinatown	1214	612	803	487	283	461	746	286	260	82	4	14	0	29	3	11	6	41	41	80	10	2	4	167	211	5,857
2. Kaka 'ako	707	367	646	422	160	169	265	86	85	25	1	5	1	13	1	2	2	30	16	18	5	3	0	88	97	3,214
3. Punchbowl-Sheridan-Date	3621	1331	2083	1898	1634	541	1011	377	353	137	9	15	1	50	5	9	42	230	51	152	34	3	16	586	909	15,098
4. Waikiki	4794	1219	2852	2784	1507	442	848	712	259	186	5	4	1	44	1	10	10	312	105	116	21	106	12	445	639	17,434
5. Kāhala- Tantalus	2456	725	1931	1935	2534	383	643	208	221	88	8	10	2	27	4	5	11	454	46	52	22	1	2	545	778	13,091
6. Pauoa-Kalihi	3032	859	847	623	403	1369	2438	670	759	248	9	19	2	67	16	17	18	39	138	125	14	2	4	263	395	12,376
7. Iwilei-Mapunapuna-Airport	1442	496	505	286	229	572	1231	489	461	179	4	9	2	44	4	13	13	22	46	36	5	14	4	128	211	6,445
8. Hickam-Pearl Harbor	478	82	136	178	39	114	366	535	368	144	7	9	0	78	15	12	14	8	18	49	5	2	7	11	73	2,748
9. Moanalua-Halawa	1461	355	405	287	227	449	1072	1338	2082	655	24	37	6	168	32	32	39	30	78	72	16	8	14	80	333	9,300
10. 'Aiea-Pearl City	1230	286	340	225	184	290	910	1301	1554	2701	69	126	8	915	153	159	163	25	65	68	27	18	43	99	450	11,409
11. Honouliuli - 'Ewa Beach	498	162	218	494	125	108	281	329	287	421	1479	504	50	744	38	63	67	37	34	52	30	10	88	91	333	6,543
12. Kapolei-Ko 'Olina - Kalaeloa	217	45	73	138	62	46	102	92	84	128	175	663	106	204	14	15	20	10	17	14	10	5	179	15	124	2,558
13. Makakilo - Makaiwa	234	64	87	201	54	59	111	67	81	73	30	195	87	76	6	8	10	18	10	19	23	2	55	33	163	1,766
14. Waipahu - Waikele - Kunia	681	130	286	588	114	114	361	429	423	1269	319	308	48	2025	272	282	196	17	33	42	33	16	112	63	255	8,416
15. Waiawa-Koa Ridge	135	23	92	95	13	26	110	105	101	266	15	25	4	360	69	169	108	5	6	5	5	7	13	4	46	1,807
16. Mililani - Melemanu-Kipapa	797	198	221	212	140	156	381	434	344	549	47	91	13	601	227	1958	1742	30	45	110	89	87	44	83	429	9,028
17. Wahiawā-Whitmore-Schofield	490	122	185	118	84	88	216	236	200	252	27	68	7	290	101	897	2003	36	28	45	44	105	20	38	215	5,915
18. East Honolulu	1364	324	845	918	1540	187	331	130	158	56	9	4	0	18	3	4	5	1449	34	114	23	5	13	232	567	8,333
19. Kāne'ohe - Kahalu'u - Kualoa	1293	288	292	287	170	362	497	276	307	148	2	18	2	69	6	18	13	27	1909	536	155	19	21	62	322	7,099
20. Kailua - Mokapu-Waimānalo	1840	351	372	325	229	363	439	267	290	146	9	23	4	76	3	21	20	90	529	2500	40	7	19	96	385	8,444
21. Ko'olauloa	175	60	69	87	39	43	65	62	60	22	6	5	3	37	3	12	12	33	79	49	911	43	5	17	61	1,958
22. North Shore	219	73	92	94	63	48	105	99	89	104	11	10	2	58	11	117	315	13	20	25	201	742	13	30	125	2,679
23. Wai'anae Coast	699	208	299	348	180	129	328	341	297	152	44	370	32	182	15	36	38	32	42	85	28	10	1800	65	395	6,155
24. Mānoa - Tantalus	2437	805	1381	1100	723	550	788	234	267	86	3	3	1	35	3	7	14	98	42	111	14	2	3	608	643	9,958
25. University	427	112	308	231	182	63	102	33	33	20	1	1	0	2	1	2	0	26	7	24	1	0	1	119	38	1,734
Total	31,941	9,297	15,368	14,361	10,918	7,132	13,747	9,136	9,423	8,137	2,317	2,536	382	6,212	1,006	3,879	4,881	3,112	3,439	4,499	1,766	1,219	2,492	3,968	8,197	179,365

Model v. Observed Difference

Model Estimate - Observed

Production District	Attraction District																										
	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala-Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapun a-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawa-Whitmore-Schofield	18. East Honolulu	19. Kane'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimanalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Manoa - Tantalus	25. University	total
1. Ward-Chinatown	134	(584)	(1,886)	(143)	(504)	180	414	(154)	140	(288)	(29)	(10)	(6)	(141)	0	(0)	(9)	(13)	19	34	2	(11)	(54)	58	(170)	(3,022)
2. Kaka 'ako	378	348	170	298	2	52	34	64	52	8	1	5	1	13	(4)	(3)	2	30	16	18	5	3	(6)	41	(12)	1,515
3. Punchbowl-Sheridan-Date	(3,097)	490	15	788	783	(66)	139	(212)	207	(856)	(5)	(50)	(1)	(212)	5	(5)	37	(294)	(172)	(66)	16	(17)	(45)	409	(244)	(2,449)
4. Waikiki	(1,961)	191	(5,837)	1,445	(1,011)	21	(17)	(518)	90	(202)	(9)	(119)	1	(499)	1	(11)	(53)	(683)	(117)	(346)	(78)	(75)	(38)	276	(909)	(10,460)
5. Kahala- Tantalus	673	(17)	(591)	714	265	127	162	4	145	(46)	(36)	10	(2)	(80)	4	2	11	98	1	(108)	13	(3)	(3)	463	(319)	1,487
6. Pauoa-Kalihi	(66)	(1,100)	(2,033)	(885)	(223)	(795)	327	186	265	(31)	(105)	(70)	(9)	(231)	13	7	(13)	15	65	(132)	9	(26)	(17)	(18)	(136)	(5,005)
7. Iwilei-Mapunapuna-Airport	(205)	(93)	(1,901)	(619)	(35)	161	453	326	187	(87)	(5)	(227)	(9)	(27)	(3)	11	(81)	(90)	12	5	5	(43)	(7)	(130)	(76)	(2,476)
8. Hickam-Pearl Harbor	192	71	(347)	(149)	(163)	(47)	294	73	316	9	(24)	(3)	0	(183)	15	12	10	6	16	49	5	2	3	11	49	218
9. Moanalua-Halawa	(11)	(778)	(582)	(46)	50	233	361	1,231	1,197	(94)	19	25	6	56	32	32	31	(13)	70	67	16	(6)	14	29	124	2,063
10. 'Aiea-Pearl City	(551)	(2)	(1,268)	(179)	(54)	181	501	1,041	1,103	897	63	71	(23)	429	151	120	131	(18)	(20)	44	27	(12)	(205)	70	70	2,569
11. Honouliuli - 'Ewa Beach	(381)	26	(281)	53	(21)	(189)	10	121	212	(198)	1,123	266	46	(394)	20	17	48	35	7	39	30	(110)	(29)	52	227	729
12. Kapolei-Ko 'Olina - Kalaeloa	2	(3)	(264)	90	31	34	67	54	5	58	150	342	89	32	14	15	(58)	6	6	14	9	1	107	12	87	899
13. Makakilo - Makaiwa	(31)	44	(30)	186	47	28	45	32	(15)	(18)	(30)	(422)	69	(24)	6	7	10	18	10	13	23	(3)	6	31	118	120
14. Waipahu - Waikele - Kunia	(1,119)	(67)	(926)	(454)	45	(170)	(337)	93	196	206	166	73	15	(1,045)	235	270	189	10	30	30	21	(1,013)	(54)	29	(2)	(3,579)
15. Waiawa-Koa Ridge	(241)	(26)	65	72	(12)	7	47	59	92	220	15	(190)	4	222	69	165	108	5	6	5	5	2	8	(2)	38	742
16. Mililani - Melemanu-Kipapa	118	56	(2)	159	100	137	247	401	254	455	44	67	13	542	153	1,905	1,650	30	38	110	59	59	44	63	334	7,036
17. Wahiawā-Whitmore-Schofield	120	19	(573)	107	82	64	23	158	127	91	20	38	(12)	145	97	647	1,423	(16)	16	(2)	43	(56)	12	29	198	2,801
18. East Honolulu	628	215	(404)	622	759	115	196	60	82	51	9	4	0	(1)	3	4	3	259	33	73	23	(9)	13	216	347	3,301
19. Kāne'ohe - Kahalu'u - Kualoa	545	115	(170)	(7)	118	262	400	258	265	111	2	(18)	2	66	4	(7)	10	2	1,021	304	31	10	(105)	42	180	3,440
20. Kailua - Mokapu-Waimanalo	667	299	(133)	130	(20)	291	204	209	212	126	9	12	(5)	72	3	21	20	(41)	(58)	1,615	39	4	17	(18)	275	3,952
21. Ko'olauloa	45	(132)	(256)	82	32	28	63	53	51	16	6	5	3	36	3	5	7	33	(247)	10	527	(341)	5	17	38	90
22. North Shore	168	57	(21)	44	43	45	90	82	85	68	7	2	2	(82)	(29)	(28)	66	2	(98)	25	13	535	11	30	108	1,223
23. Wai'anae Coast	(285)	55	(66)	100	65	(153)	73	(111)	40	(440)	(138)	(104)	23	(190)	9	30	34	32	38	65	7	(65)	(452)	43	374	(1,016)
24. Mānoa - Tantalus	(1,437)	608	(2,217)	383	406	309	275	75	114	(168)	(10)	(25)	(5)	(117)	3	7	6	7	8	28	14	(64)	(0)	222	(203)	(1,782)
25. University	(187)	(71)	(485)	2	(35)	9	(140)	19	27	(77)	1	(1)	(7)	(198)	1	2	(0)	8	(16)	(15)	1	(18)	1	15	12	(1,153)
Total	(5,901)	(279)	(20,024)	2,792	750	864	3,929	3,605	5,451	(190)	1,245	(320)	196	(1,810)	805	3,225	3,581	(573)	685	1,877	865	(1,258)	(773)	1,989	511	1,244

Newly Expanded 2005 On-Board Survey using Route, Time of Day, Direction, and Bus Stop Location

Attraction District

Production District	1: Ward-Chinatown	2: Kaka 'ako	3: Punchbowl-Sheridan-Date	4: Waikiki	5: Kahala - Tantalus	6: Pauoa-Kalihi	7: Iwilei-Mapunapuna-Airport	8: Hickam-Pearl Harbor	9: Moanalua-Halawa	10: 'Aiea-Pearl City	11: Honouliuli - 'Ewa Beach	12: Kapolei-Ko 'Olina - Kalaeloa	13: Makakilo - Makaiwa	14: Waipahu - Waikele - Kunia	15: Waiawa-Koa Ridge	16: Mililani - Melemanu-Kipapa	17: Wahiawa-Whitmore-Schofield	18: East Honolulu	19: Kane'ohe - Kahalu'u - Kualoa	20: Kailua - Mokapu-Waimanalo	21: Ko'olauloa	22: North Shore	23: Wai'anae Coast	24: Manoa - Tantalus	25: University	total
1. Ward-Chinatown	1,080	1,196	2,689	630	787	281	332	440	120	370	33	24	6	170	3	11	15	54	22	46	8	13	58	109	381	8,879
2. Kaka 'ako	329	19	476	124	158	117	231	22	33	17					5	5							6	47	109	1,699
3. Punchbowl-Sheridan-Date	6,718	841	2,068	1,110	851	607	872	589	146	993	14	65	2	262		14	5	524	223	218	18	20	61	177	1,153	17,547
4. Waikīkī	6,755	1,028	8,689	1,339	2,518	421	865	1,230	169	388	14	123		543		21	63	995	222	462	99	181	50	169	1,548	27,894
5. Kāhala- Tantalus	1,783	742	2,522	1,221	2,269	256	481	204	76	134	44	0	4	107		3		356	45	160	9	4	5	82	1,097	11,604
6. Pauoa-Kalihi	3,098	1,959	2,880	1,508	626	2,164	2,111	484	494	279	114	89	11	298	3	10	31	24	73	257	5	28	21	281	531	17,381
7. Iwilei-Mapunapuna-Airport	1,647	589	2,406	905	264	411	778	163	274	266	9	236	11	71	7	2	94	112	34	31		57	11	258	287	8,921
8. Hickam-Pearl Harbor	286	11	483	327	202	161	72	462	52	135	31	12		261			4	2	2				4	0	24	2,530
9. Moanalua-Halawa	1,472	1,133	987	333	177	216	711	107	885	749	5	12		112	0		8	43	8	5		14		51	209	7,237
10. 'Aiea-Pearl City	1,781	288	1,608	404	238	109	409	260	451	1,804	6	55	31	486	2	39	32	43	85	24		30	248	29	380	8,840
11. Honouliuli - 'Ewa Beach	879	136	499	441	146	297	271	208	75	619	356	238	4	1,138	18	46	19	2	27	13		120	117	39	106	5,814
12. Kapolei-Ko 'Olina - Kalaeloa	215	48	337	48	31	12	35	38	79	70	25	321	17	172			78	4	11	0	1	4	72	3	37	1,659
13. Makakilo - Makaiwa	265	20	117	15	7	31	66	35	96	91	60	617	18	100		1			0	6		5	49	2	45	1,646
14. Waipahu - Waikele - Kunia	1,800	197	1,212	1,042	69	284	698	336	227	1,063	153	235	33	3,070	37	12	7	7	3	12	12	1,029	166	34	257	11,995
15. Waiawa-Koa Ridge	376	49	27	23	25	19	63	46	9	46		215		138		4						5	5	6	8	1,065
16. Mililani - Melemanu-Kipapa	679	142	223	53	40	19	134	33	90	94	3	24		59	74	53	92		7		30	28		20	95	1,992
17. Wahiawa-Whitmore-Schofield	370	103	758	11	2	24	193	78	73	161	7	30	19	145	4	250	580	52	12	47	1	161	8	9	17	3,114
18. East Honolulu	736	109	1,249	296	781	72	135	70	76	5				19			2	1,190	1	41		14		16	220	5,032
19. Kane'ohe - Kahalu'u - Kualoa	748	173	462	294	52	100	97	18	42	37		36		3	2	25	3	25	888	232	124	9	126	20	142	3,659
20. Kailua - Mokapu-Waimānalo	1,173	52	505	195	249	72	235	58	78	20		11	9	4		0		131	587	885	1	3	2	114	110	4,492
21. Ko'olauloa	130	192	325	5	7	15	2	9	9	6				1		7	5		326	39	384	384			23	1,868
22. North Shore	51	16	113	50	20	3	15	17	4	36	4	8		140	40	145	249	11	118		188	207	2		17	1,456
23. Wai'anae Coast	984	153	365	248	115	282	255	452	257	592	182	474	9	372	6	6	4		4	20	21	75	2,252	22	21	7,171
24. Mānoa - Tantalus	3,874	197	3,598	717	317	241	513	159	153	254	13	28	6	152			8	91	34	83		66	3	386	846	11,740
25. University	614	183	793	229	217	54	242	14	6	97		2	7	200			0	18	23	39		18		104	26	2,887
	37,842	9,576	35,392	11,569	10,168	6,268	9,818	5,531	3,972	8,327	1,072	2,856	186	8,022	201	654	1,300	3,685	2,754	2,622	901	2,477	3,265	1,979	7,686	178,121

2005 OBS Total Daily Transit Trips P to A format with OLD expansion Factor (route, TOD, direction)

Attraction District

Production District	1: Ward-Chinatown	2: Kaka 'ako	3: Punchbowl-Sheridan-Date	4: Waikiki	5: Kahala-Tantalus	6: Pauoa-Kalihi	7: Iwilei-Mapunapuna Airport	8: Hickam-Pearl Harbor	9: Moanalua-Halawa	10: 'Aiea-Pearl City	11: Honouliuli - 'Ewa Beach	12: Kapolei-Ko 'Olina - Kalaeloa	13: Makakilo - Makaiwa	14: Waipahu - Waikele - Kunia	15: Waiawa-Koa Ridge	16: Mililani - Melemanu-Kipapa	17: Wahiawa-Whitmore-Schofield	18: East Honolulu	19: Kane'ohe - Kahalu'u - Kualoa	20: Kailua - Mokapu-Waimanalo	21: Ko'olauloa	22: North Shore	23: Wai'anae Coast	24: Manoa - Tantalus	25: University	total
1. Ward-Chinatown	1,238	708	2,105	981	1,215	157	354	317	132	312	35	17	8	123	25	35	32	51	48	90	0	3	38	145	440	8,609
2. Kaka 'ako	343	22	571	216	236	143	279	27	40	35	0	0	0	9	2	0	7	3	0	13	0	11	11	38	109	2,115
3. Punchbowl-Sheridan-Date	4,336	941	2,314	1,764	1,090	563	999	373	213	677	5	54	2	169	13	6	14	501	133	211	55	125	61	236	1,212	16,067
4. Waikīkī	7,013	1,424	7,873	2,229	2,024	745	748	1,674	178	270	10	21	0	435	0	78	129	1,297	204	496	134	259	88	158	1,864	29,351
5. Kāhala- Tantalus	3,065	916	3,205	1,040	2,843	196	689	254	69	80	39	9	5	61	0	18	0	544	66	155	2	6	4	66	893	14,225
6. Pauoa-Kalihi	3,166	1,314	2,557	1,868	987	1,204	1,877	390	362	340	62	102	14	177	10	22	16	41	141	196	4	26	16	419	683	15,994
7. Iwilei-Mapunapuna-Airport	1,379	850	2,060	1,287	193	522	734	194	585	647	10	94	10	69	19	12	61	152	108	54	0	39	31	113	210	9,433
8. Hickam-Pearl Harbor	402	56	329	223	133	114	32	218	27	55	0	5	0	285	8	8	5	20	4	8	0	0	0	2	28	1,962
9. Moanalua-Halawa	1,277	368	866	716	184	216	604	174	725	814	46	19	0	114	1	8	4	67	7	10	0	11	0	47	213	6,491
10. 'Aiea-Pearl City	1,810	226	1,239	439	435	196	417	346	443	1,348	6	129	2	481	18	57	37	49	142	46	0	40	176	30	302	8,414
11. Honouliuli - 'Ewa Beach	807	117	548	536	216	362	187	269	93	523	909	298	15	882	42	47	47	14	27	43	7	59	93	61	76	6,278
12. Kapolei-Ko 'Olina - Kalaeloa	335	64	314	78	21	20	97	25	48	96	42	273	21	157	0	0	38	2	14	9	2	7	54	5	15	1,737
13. Makakilo - Makaiwa	186	41	119	1	7	36	63	23	108	77	71	685	30	81	0	2	0	0	1	3	0	4	40	2	57	1,637
14. Waipahu - Waikele - Kunia	1,712	149	1,099	948	59	219	499	328	406	1,221	283	240	10	2,902	106	14	30	5	7	12	24	777	147	76	363	11,636
15. Waiawa-Koa Ridge	259	27	122	21	14	18	49	24	28	85	0	14	0	126	0	21	0	5	0	0	0	39	8	6	11	877
16. Mililani - Melemanu-Kipapa	810	117	264	67	37	15	215	78	36	150	6	11	0	99	48	79	127	0	18	13	49	40	0	27	80	2,386
17. Wahiawā-Whitmore-Schofield	544	21	455	45	10	34	269	63	85	258	9	20	10	118	15	213	509	47	10	60	10	129	37	11	34	3,016
18. East Honolulu	898	115	827	275	1,193	140	178	34	56	12	0	0	0	42	0	0	0	871	0	112	0	10	0	140	568	5,471
19. Kāne'ohe - Kahalu'u - Kualoa	776	189	594	226	49	75	120	18	42	40	0	16	0	3	2	46	6	20	1,009	226	97	22	101	23	105	3,805
20. Kailua - Mokapu-Waimānalo	807	106	421	173	357	94	152	109	90	38	0	14	15	3	0	3	0	179	531	887	8	5	20	81	139	4,232
21. Ko'olauloa	205	24	182	6	29	35	8	25	15	21	0	0	0	3	0	21	19	0	416	65	443	123	0	0	24	1,664
22. North Shore	94	9	84	37	52	14	21	20	0	43	4	18	0	115	11	78	109	37	35	0	115	234	5	0	10	1,145
23. Wai'anae Coast	1,205	235	567	261	140	109	390	431	219	677	99	626	21	524	5	12	11	0	6	27	11	51	2,300	54	50	8,031
24. Mānoa - Tantalus	2,299	215	2,162	864	523	136	497	202	196	95	6	39	6	199	0	3	16	291	43	109	0	28	6	327	982	9,244
25. University	698	264	1,316	331	453	109	336	21	6	156	0	3	11	251	0	0	6	34	23	32	0	4	0	132	69	4,255
	35,664	8,518	32,193	14,632	12,500	5,472	9,814	5,637	4,202	8,070	1,642	2,707	180	7,428	325	783	1,223	4,230	2,993	2,877	961	2,052	3,236	2,199	8,537	178,075

Observed Differences

New Expanded Observed - Old Expanded Observed																											
	Attraction District																										
Production District	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala- Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapuna-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawa-Whitmore-Schofield	18. East Honolulu	19. Kane'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimanalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Manoa - Tantalus	25. University	total
1. Ward-Chinatown	(158)	488	584	(351)	(428)	124	(22)	123	(12)	58	(2)	7	(2)	47	(22)	(24)	(17)	3	(26)	(44)	8	10	20	(36)	(59)	270
2. Kaka 'ako	(14)	(3)	(95)	(92)	(78)	(26)	(48)	(5)	(7)	(18)	0	0	0	(9)	3	5	(7)	(3)	0	(13)	0	(11)	(5)	9	(0)	(416)
3. Punchbowl-Sheridan-Date	2,382	(100)	(246)	(654)	(239)	44	(127)	216	(67)	316	9	11	(0)	93	(13)	8	(9)	23	90	7	(37)	(105)	(0)	(59)	(59)	1,480
4. Waikiki	(258)	(396)	816	(890)	494	(324)	117	(444)	(9)	118	4	102	0	108	0	(57)	(66)	(302)	18	(34)	(35)	(78)	(38)	11	(316)	(1,457)
5. Kahala- Tantalus	(1,282)	(174)	(683)	181	(574)	60	(208)	(50)	7	54	5	(9)	(1)	46	0	(15)	0	(188)	(21)	5	7	(2)	1	16	204	(2,621)
6. Pauoa-Kalihi	(68)	645	323	(360)	(361)	960	234	94	132	(61)	52	(13)	(3)	121	(7)	(12)	15	(17)	(68)	61	1	2	5	(138)	(152)	1,387
7. Iwilei-Mapunapuna-Airport	268	(261)	346	(382)	71	(111)	44	(31)	(311)	(381)	(1)	142	1	2	(12)	(10)	33	(40)	(74)	(23)	0	18	(20)	145	77	(512)
8. Hickam-Pearl Harbor	(116)	(45)	154	104	69	47	40	244	25	80	31	7	0	(24)	(8)	(8)	(1)	(18)	(2)	(8)	0	0	4	(2)	(4)	568
9. Moanalua-Halawa	195	765	121	(383)	(7)	(0)	107	(67)	160	(65)	(41)	(7)	0	(2)	(1)	(8)	4	(24)	1	(5)	0	3	0	4	(4)	746
10. 'Aiea-Pearl City	(29)	62	369	(35)	(197)	(87)	(8)	(86)	8	456	(0)	(74)	29	5	(16)	(18)	(5)	(6)	(57)	(22)	0	(10)	72	(1)	78	426
11. Honouliuli - 'Ewa Beach	72	19	(49)	(95)	(70)	(65)	84	(61)	(18)	96	(553)	(60)	(11)	256	(24)	(1)	(28)	(12)	(0)	(30)	(7)	61	24	(22)	30	(464)
12. Kapolei-Ko 'Olina - Kalaeloa	(120)	(16)	23	(30)	10	(8)	(62)	13	31	(26)	(17)	48	(4)	15	0	0	40	2	(3)	(9)	(1)	(3)	18	(2)	22	(78)
13. Makakilo - Makaiwa	79	(21)	(2)	14	0	(5)	3	12	(12)	14	(11)	(68)	(12)	19	0	(1)	0	0	(1)	3	0	1	9	(0)	(12)	9
14. Waipahu - Waikele - Kunia	88	48	113	94	10	65	199	8	(179)	(158)	(130)	(5)	23	168	(69)	(2)	(23)	2	(4)	0	(12)	252	19	(42)	(106)	359
15. Waiawa-Koa Ridge	117	22	(95)	2	11	1	14	22	(19)	(39)	0	201	0	12	0	(17)	0	(5)	0	0	0	(34)	(3)	0	(3)	188
16. Mililani - Melemanu-Kipapa	(131)	25	(41)	(14)	3	4	(81)	(45)	54	(56)	(3)	13	0	(40)	26	(26)	(35)	0	(11)	(13)	(19)	(12)	0	(7)	15	(394)
17. Wahiawa-Whitmore-Schofield	(174)	82	303	(34)	(8)	(10)	(76)	15	(12)	(97)	(2)	10	9	27	(11)	37	71	5	2	(13)	(9)	32	(29)	(2)	(17)	98
18. East Honolulu	(162)	(6)	422	21	(412)	(68)	(43)	36	20	(7)	0	0	0	(23)	0	0	2	319	1	(71)	0	4	0	(124)	(348)	(439)
19. Kane'ohe - Kahalu'u - Kualoa	(28)	(16)	(132)	68	3	25	(23)	0	0	(3)	0	20	0	(0)	0	(21)	(3)	5	(121)	6	27	(13)	25	(3)	37	(146)
20. Kailua - Mokapu-Waimānalo	366	(54)	84	22	(108)	(22)	83	(51)	(12)	(18)	0	(3)	(6)	1	0	(3)	0	(48)	56	(2)	(7)	(2)	(18)	33	(29)	260
21. Ko'olauloa	(75)	168	143	(1)	(22)	(20)	(6)	(16)	(6)	(15)	0	0	0	(2)	0	(14)	(14)	0	(90)	(26)	(59)	261	0	0	(1)	204
22. North Shore	(43)	7	29	13	(32)	(11)	(6)	(3)	4	(7)	0	(10)	0	25	29	67	140	(26)	83	0	73	(27)	(3)	0	7	311
23. Wai'anae Coast	(221)	(82)	(202)	(13)	(25)	173	(135)	21	38	(85)	83	(152)	(12)	(152)	1	(6)	(7)	0	(2)	(7)	10	24	(48)	(32)	(29)	(860)
24. Manoa - Tantalus	1,575	(18)	1,436	(147)	(206)	105	16	(43)	(43)	159	7	(11)	(0)	(47)	0	(3)	(8)	(200)	(9)	(26)	0	38	(3)	59	(136)	2,496
25. University	(84)	(81)	(523)	(102)	(236)	(55)	(94)	(7)	0	(59)	0	(1)	(4)	(51)	0	0	(6)	(16)	(0)	7	0	14	0	(28)	(43)	(1,368)
Total	2,178	1,058	3,199	(3,063)	(2,332)	796	4	(106)	(230)	257	(570)	149	6	594	(124)	(129)	77	(545)	(239)	(255)	(60)	425	29	(220)	(851)	46

2005 Model 9/5/06 Total Daily Transit Trips P to A format

Production District	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala-Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapuna-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawā-Whitmore-Schofield	18. East Honolulu	19. Kāne'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimanalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Mānoa - Tantalus	25. University	total
1. Ward-Chinatown	1,453	845	786	420	326	510	824	253	263	92	4	4	2	23	3	13	10	41	52	65	9	2	8	167	214	6,389
2. Kaka 'ako	791	572	804	429	168	195	284	81	76	34	4	2	0	14	1	6	4	29	17	19	4	6	5	98	119	3,762
3. Punchbowl-Sheridan-Date	3,478	1619	2,304	1,863	1,710	556	937	325	327	120	9	9	0	34	4	6	34	225	44	134	29	6	22	637	997	15,429
4. Waikiki	4,844	1,367	3,057	2,975	1,587	418	825	719	244	187	4	8	2	45	2	11	6	322	90	126	22	109	10	435	661	18,076
5. Kahala- Tantalus	1,929	701	1,634	1,647	2,323	314	520	151	179	74	7	6	2	36	1	13	8	469	40	38	9	4	5	513	671	11,294
6. Pauoa-Kalihi	2,926	964	806	565	385	1,438	2,574	573	720	223	7	10	5	50	10	23	13	41	112	121	23	5	8	256	348	12,206
7. Iwilei-Mapunapuna-Airport	1,420	581	483	257	227	654	1601	500	479	190	2	12	3	26	9	8	14	26	44	30	7	13	12	137	186	6,921
8. Hickam-Pearl Harbor	422	77	131	178	38	120	367	659	490	138	10	7	2	60	21	10	12	12	16	77	3	6	7	16	61	2,940
9. Moanalua-Halawa	1,291	361	370	237	203	412	1018	1454	2333	667	23	23	5	139	37	28	36	34	64	86	20	9	19	74	308	9,251
10. 'Aiea-Pearl City	1,115	306	313	240	178	266	809	1231	1584	3,007	74	104	16	704	140	171	131	33	61	64	44	22	69	84	391	11,157
11. Honouliuli - 'Ewa Beach	488	162	197	473	113	113	247	345	275	386	1491	653	39	618	42	67	56	32	29	39	26	13	95	77	303	6,379
12. Kapolei-Ko 'Olina - Kalaeloa	198	60	61	119	36	35	79	99	80	150	172	538	50	218	15	26	23	11	14	17	8	4	154	24	111	2,302
13. Makakilo - Makaiwa	228	73	86	201	61	59	104	91	87	98	25	237	60	71	11	15	8	13	12	18	20	2	56	32	179	1,847
14. Waipahu - Waikele - Kunia	655	151	300	643	102	116	349	415	383	1,110	400	346	39	1,948	247	238	124	27	36	46	23	14	105	55	247	8,119
15. Waiawa-Koa Ridge	146	30	94	114	14	22	113	109	111	264	33	29	5	357	85	155	95	4	3	9	8	7	14	10	45	1,876
16. Mililani - Melemanu-Kipapa	854	227	224	241	127	169	379	425	347	429	52	69	8	410	219	1945	1428	30	34	101	49	85	38	54	396	8,340
17. Wahiawā-Whitmore-Schofield	451	130	148	132	82	80	189	205	172	195	22	29	1	196	88	832	1838	33	20	46	28	88	24	29	218	5,276
18. East Honolulu	1203	396	737	736	1,418	189	333	145	152	54	10	15	3	18	1	14	6	1411	22	120	26	6	31	241	547	7,834
19. Kāne'ohe - Kahalu'u - Kualoa	1200	332	279	272	166	373	500	276	324	173	7	17	0	53	8	16	14	40	2,186	577	170	17	22	83	291	7,396
20. Kailua - Mokapu-Waimānalo	1737	414	371	319	226	389	416	278	285	152	10	26	2	61	7	21	24	96	616	3019	59	8	40	113	399	9,088
21. Ko'olauloa	191	70	87	96	40	40	70	74	65	24	3	3	1	38	4	14	13	30	65	48	1015	47	7	22	77	2,144
22. North Shore	227	89	89	96	56	44	118	98	92	90	7	6	3	43	17	121	296	12	22	21	171	828	12	27	160	2,745
23. Wai'anae Coast	722	268	308	374	184	120	343	417	312	173	53	245	31	153	23	36	41	41	44	68	28	9	2,186	67	438	6,684
24. Mānoa - Tantalus	2,268	943	1,368	966	674	480	711	183	208	78	4	8	0	23	2	12	4	76	35	107	16	1	9	576	645	9,397
25. University	381	100	286	197	186	58	84	23	25	17	0	3	0	5	2	2	2	28	3	23	1	1	1	94	55	1,577
Total	30,618	10,838	15,323	13,790	10,630	7,170	13,794	9,129	9,613	8,125	2,433	2,409	279	5,343	999	3,803	4,240	3,116	3,681	5,019	1,818	1,312	2,959	3,921	8,067	178,429

Difference : AA Model - Observed

Production District	1. Ward-Chinatown	2. Kaka 'ako	3. Punchbowl-Sheridan-Date	4. Waikiki	5. Kahala-Tantalus	6. Pauoa-Kalihi	7. Iwilei-Mapunapuna-Airport	8. Hickam-Pearl Harbor	9. Moanalua-Halawa	10. 'Aiea-Pearl City	11. Honouliuli - 'Ewa Beach	12. Kapolei-Ko 'Olina - Kalaeloa	13. Makakilo - Makaiwa	14. Waipahu - Waikele - Kunia	15. Waiawa-Koa Ridge	16. Mililani - Melemanu-Kipapa	17. Wahiawā-Whitmore-Schofield	18. East Honolulu	19. Kāne'ohe - Kahalu'u - Kualoa	20. Kailua - Mokapu-Waimanalo	21. Ko'olauloa	22. North Shore	23. Wai'anae Coast	24. Mānoa - Tantalus	25. University	total
1. Ward-Chinatown	373	(351)	(1,903)	(210)	(461)	229	492	(187)	143	(278)	(29)	(20)	(4)	(147)	0	2	(5)	(13)	30	19	1	(11)	(50)	58	(167)	(2,490)
2. Kaka 'ako	462	553	328	305	10	78	53	59	43	17	4	2	0	14	(4)	1	4	29	17	19	4	6	(1)	51	10	2,063
3. Punchbowl-Sheridan-Date	(3,240)	778	236	753	859	(51)	65	(264)	181	(873)	(5)	(56)	(2)	(228)	4	(8)	29	(299)	(179)	(84)	11	(14)	(39)	460	(156)	(2,118)
4. Waikiki	(1,911)	339	(5,632)	1,636	(931)	(3)	(40)	(511)	75	(201)	(10)	(115)	2	(498)	2	(10)	(57)	(673)	(132)	(336)	(77)	(72)	(40)	266	(887)	(9,818)
5. Kahala- Tantalus	146	(41)	(888)	426	54	58	39	(53)	103	(60)	(37)	6	(2)	(71)	1	10	8	113	(5)	(122)	(0)	(0)	0	431	(426)	(310)
6. Pauoa-Kalihi	(172)	(995)	(2,074)	(943)	(241)	(726)	463	89	226	(56)	(107)	(79)	(6)	(248)	7	13	(18)	17	39	(136)	18	(23)	(13)	(25)	(183)	(5,175)
7. Iwilei-Mapunapuna-Airport	(227)	(8)	(1,923)	(648)	(37)	243	823	337	205	(76)	(7)	(224)	(8)	(45)	2	6	(80)	(86)	10	(1)	7	(44)	1	(121)	(101)	(2,000)
8. Hickam-Pearl Harbor	136	66	(352)	(149)	(164)	(41)	295	197	438	3	(21)	(5)	2	(201)	21	10	8	10	14	77	3	6	3	16	37	410
9. Moanalua-Halawa	(181)	(772)	(617)	(96)	26	196	307	1,347	1,448	(82)	18	11	5	27	37	28	28	(9)	56	81	20	(5)	19	23	99	2,014
10. 'Aiea-Pearl City	(666)	18	(1,295)	(164)	(60)	157	400	971	1,133	1,203	68	49	(15)	218	138	132	99	(10)	(24)	40	44	(8)	(179)	55	11	2,317
11. Honouliuli - 'Ewa Beach	(391)	26	(302)	32	(33)	(184)	(24)	137	200	(233)	1,135	415	35	(520)	24	21	37	30	2	26	26	(107)	(22)	38	197	565
12. Kapolei-Ko 'Olina - Kalaeloa	(17)	12	(276)	71	5	23	44	61	1	80	147	217	33	46	15	26	(55)	7	3	17	7	(0)	82	21	74	643
13. Makakilo - Makaiwa	(37)	53	(31)	186	54	28	38	56	(9)	7	(35)	(380)	42	(29)	11	14	8	13	12	12	20	(3)	7	30	134	201
14. Waipahu - Waikele - Kunia	(1,145)	(46)	(912)	(399)	33	(168)	(349)	79	156	47	247	111	6	(1,122)	210	226	117	20	33	34	11	(1,015)	(61)	21	(10)	(3,876)
15. Waiawa-Koa Ridge	(230)	(19)	67	91	(11)	3	50	63	102	218	33	(186)	5	219	85	151	95	4	3	9	8	2	9	4	37	811
16. Mililani - Melemanu-Kipapa	175	85	1	188	87	150	245	392	257	335	49	45	8	351	145	1,892	1,336	30	27	101	19	57	38	34	301	6,348
17. Wahiawā-Whitmore-Schofield	81	27	(610)	121	80	56	(4)	127	99	34	15	(1)	(18)	51	84	582	1,258	(19)	8	(1)	27	(73)	16	20	201	2,162
18. East Honolulu	467	287	(512)	440	637	117	198	75	76	49	10	15	3	(1)	1	14	4	221	21	79	26	(8)	31	225	327	2,802
19. Kāne'ohe - Kahalu'u - Kualoa	452	159	(183)	(22)	114	273	403	258	282	136	7	(19)	0	50	6	(9)	11	15	1,298	345	46	8	(104)	63	149	3,737
20. Kailua - Mokapu-Waimānalo	564	362	(134)	124	(23)	317	181	220	207	132	10	15	(7)	57	7	21	24	(35)	29	2,134	58	5	38	(1)	289	4,596
21. Ko'olauloa	61	(122)	(238)	91	33	25	68	65	56	18	3	3	1	37	4	7	8	30	(261)	9	631	(337)	7	22	54	276
22. North Shore	176	73	(24)	46	36	41	103	81	88	54	3	(2)	3	(97)	(23)	(24)	47	1	(96)	21	(17)	621	10	27	143	1,289
23. Wai'anae Coast	(262)	115	(57)	126	69	(162)	88	(35)	55	(419)	(129)	(229)	22	(219)	17	30	37	41	40	48	7	(66)	(66)	45	417	(487)
24. Mānoa - Tantalus	(1,606)	746	(2,230)	249	357	239	198	24	55	(176)	(9)	(20)	(6)	(129)	2	12	(4)	(15)	1	24	16	(65)	6	190	(201)	(2,343)
25. University	(233)	(83)	(507)	(32)	(31)	4	(158)	9	19	(80)	0	1	(7)	(195)	2	2	2	10	(20)	(16)	1	(17)	1	(10)	29	(1,310)
Total	(7,224)	1,262	(20,069)	2,221	462	902	3,976	3,598	5,641	(202)	1,361	(447)	93	(2,679)	798	3,149	2,940	(569)	927	2,397	917	(1,165)	(306)	1,942	381	308

Appendix E 2030 Forecast Summary

Boardings - resident + visitor

Year	Local Bus	Express Bus	Fixed Guideway	Ferry	Total	Xfer Rate
2005 AA Calibrated	233,206	9,909	-	-	**243,115**	1.36
2005 4/23/07 CALIBRATION	234,734	8,150	-	-	**242,884**	1.35
2017 OPENING YEAR NOBUILD Submittal May 07	293,715	7,896	-	43	**301,654**	1.40
2017 OPENING YEAR TSM Submittal May 07	339,653	10,093	-	86	**349,832**	1.47
2017 OPENING YEAR MOS L Submittal May 07	344,435	2,175	65,622	29	**412,261**	1.62
2030 NOBUILD Submittal May 07	330,365	9,379	-	149	**339,893**	1.43
2030 TSM Submittal May 07	381,703	11,354	-	179	**393,236**	1.50
2030 MOSL Submittal May 07	390,552	2,156	83,176	279	**476,163**	1.66
2005 Transit Skims with 2030 NB HwySk/Person Trips	295,825	10,470	-	-	**306,295**	1.37
2005 HwySk/Person Trips with 2030 MOS L Tran Skims	305,138	1,903	62,826	7	**369,874**	1.67
2005 HwySk/Person Trips with 2017 MOS L Tran Skims	304,494	1,980	61,414	3	**367,891**	1.66

These are the runs we are using in the May 2007 submittal

LINKED TRIPS - resident + visitor

Year	Total transit trips	Total Trips	Transit Mode Share	Growth	Resident Transit Trips Only
2005 AA Calibrated	178,417	3,090,771	5.8%		159,855
2005 4/23/07 CALIBRATION	179,365	3,101,096	5.8%	-	161,478
2017 OPENING YEAR NOBUILD Submittal May 07	215,379	3,537,494	6.1%		194,388
2017 OPENING YEAR TSM Submittal May 07	238,223	3,537,659	6.7%		217,060
2017 OPENING YEAR MOS L Submittal May 07	254,717	3,537,483	7.2%		232,719
2030 NOBUILD Submittal May 07	237,857	3,913,971	6.1%		216,651
2030 TSM Submittal May 07	262,228	3,914,025	6.7%		241,065
2030 MOSL Submittal May 07	287,215	3,913,886	7.3%		265,266
2005 Transit Skims with 2030 NB HwySk/Person Trips	223,326	3,922,825	5.7%		202,602
2005 HwySk/Person Trips with 2030 MOS L Tran Skims	221,830	3,101,007	7.2%	23.7%	203,367
2005 HwySk/Person Trips with 2017 MOS L Tran Skims	222,040	3,101,031	7.2%		203,575

These are the runs we are using in the May 2007 submittal

What if the Fixed-Guideway System was in-place in 2005

2030 NOBUILD

		WH		WO		WW		WN		AW		AN		NC		NK		NS		NO		NN		total		
		Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	*Total*
Station		Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	**Ride**	**Ride**	*Drive*
Number	Name	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	**Trips**	**Trips**	*Access*
2643	HawaiiKai	44	731	0	12	0	96	0	1	0	110	0	0	0	68	1	128	0	79	0	154	0	86	**45**	**1,465**	***1,510***
2484	MililMauka	8	116	0	4	0	31	0	1	0	177	0	0	0	2	0	56	0	67	0	75	0	115	**8**	**644**	***652***
2765	Wahiawa	56	1001	0	17	0	237	0	3	0	201	0	0	1	178	1	162	0	80	0	123	0	108	**58**	**2,110**	***2,168***
2571	RoyalKunia	100	1676	0	25	0	294	0	3	0	249	0	0	1	181	1	200	0	63	0	159	0	162	**102**	**3,012**	***3,114***
3553	CaneCalif	26	464	0	6	0	91	0	1	0	169	0	0	0	40	0	47	0	26	0	161	0	86	**26**	**1,091**	***1,117***
Total		234	3987	0	64	0	749	0	9	0	906	0	0	1	469	3	592	0	315	0	672	0	557	**238**	**8,320**	***8,558***
																				Grand Total				**1,790**	**23,041**	***24,831***
																				Percent of Grand Total	→			**13.3%**	**36.1%**	**34.5%**

2030 TSM

		WH		WO		WW		WN		AW		AN		NC		NK		NS		NO		NN		total		
		Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	*Total*
Station		Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	**Ride**	**Ride**	*Drive*
Number	Name	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	**Trips**	**Trips**	*Access*
2643	HawaiiKai	49	856	0	13	0	111	0	1	0	110	0	0	0	74	1	144	0	82	0	160	0	86	**50**	**1,637**	***1,687***
3791	MililMauka	10	177	0	2	0	25	0	0	0	26	0	0	0	58	0	32	0	6	0	47	0	22	**10**	**395**	***405***
2765	Wahiawa	36	661	0	13	0	190	0	2	0	254	0	0	0	124	1	157	0	101	0	110	0	136	**37**	**1,748**	***1,785***
2571	RoyalKunia	31	542	0	6	0	111	0	1	0	32	0	0	0	51	0	58	0	8	0	17	0	29	**31**	**855**	***886***
3896	FarrNSRd	255	4582	0	36	0	598	0	5	0	674	0	0	4	1374	2	620	0	194	0	540	0	383	**261**	**9,006**	***9,267***
3892	UHWONSRd	16	241	0	5	0	68	0	2	0	140	0	0	0	0	0	83	0	39	0	39	0	83	**16**	**700**	***716***
3648	H2KaUka	77	1397	0	12	0	290	0	3	0	165	0	0	1	349	0	69	0	47	0	193	0	111	**78**	**2,636**	***2,714***
4022	Hanua	34	554	0	8	0	144	0	2	0	329	0	0	0	3	0	41	0	88	0	89	0	121	**34**	**1,379**	***1,413***
2031	Kahuapaani	333	1572	2	13	1	521	0	6	1	693	0	0	9	287	52	160	1	128	2	245	8	343	**409**	**3,968**	***4,377***
3553	CaneCalif	24	427	0	6	0	73	0	1	0	146	0	0	0	37	0	133	0	17	0	87	0	66	**24**	**993**	***1,017***
Total		864	11008	3	116	1	2130	0	25	1	2569	0	1	15	2357	58	1495	1	708	2	1528	8	1379	**953**	**23,316**	***24,269***
																				Grand Total				**2,060**	**41,663**	***43,723***
																				Percent of Grand Total	→			**46.3%**	**56.0%**	**55.5%**

2030 MOS L

		WH		WO		WW		WN		AW		AN		NC		NK		NS		NO		NN		total		
		Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	Park	Kiss	*Total*
Station		Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	Ride	**Ride**	**Ride**	*Drive*
Number	Name	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	Trips	**Trips**	**Trips**	*Access*
2643	HawaiiKai	48	866	0	13	0	112	0	1	0	110	0	0	0	75	1	144	0	81	0	159	0	84	**49**	**1,645**	***1,694***
3791	MililMauka	2	45	0	1	0	16	0	0	0	23	0	0	0	1	0	25	0	2	0	13	0	17	**2**	**143**	***145***
2765	Wahiawa	52	948	0	11	0	264	0	3	0	209	0	0	1	304	0	115	0	67	0	84	0	114	**53**	**2,119**	***2,172***
3553	CaneCalif	32	568	0	9	0	109	0	2	0	152	0	0	0	36	1	169	0	16	0	85	0	74	**33**	**1,220**	***1,253***
2571	RoyalKunia	3	39	0	1	0	12	0	0	0	13	0	0	0	0	0	34	0	3	0	7	0	12	**3**	**121**	***124***
3648	H2KaUka	17	271	0	6	0	74	0	1	0	94	0	0	0	3	0	22	0	19	0	73	0	63	**17**	**626**	***643***
3892	UHWONSRd	26	405	0	6	0	106	0	2	0	274	0	0	0	0	0	73	0	57	0	87	0	146	**26**	**1,156**	***1,182***
3896	UHWOFarr	61	954	0	10	0	221	0	3	0	516	0	0	0	99	0	67	0	128	0	137	0	214	**61**	**2,349**	***2,410***
3990	PearlHigh	4	76	0	0	0	18	0	0	0	66	0	0	0	0	0	6	0	7	0	16	0	38	**4**	**227**	***231***
2031	Kahuapaani	91	908	0	9	0	322	0	4	0	747	0	0	0	0	5	121	0	87	0	179	1	254	**97**	**2,631**	***2,728***
4711	Kahuapaani	307	1781	2	8	1	821	0	8	1	1165	0	0	10	636	50	118	1	104	2	239	7	465	**381**	**5,345**	***5,726***
4708	PearlHigh	249	5307	0	22	0	828	0	6	0	612	0	0	3	1273	1	337	0	153	0	425	0	351	**253**	**9,314**	***9,567***
4703	FarrNSRd	122	2271	0	16	0	318	0	3	0	136	0	0	1	532	1	326	0	45	0	140	0	80	**124**	**3,867**	***3,991***
4702	UH-WO	178	3562	0	20	0	370	0	3	0	80	0	0	2	842	1	305	0	39	0	144	0	50	**181**	**5,415**	***5,596***
Total		1191	18001	3	131	1	3592	0	36	1	4197	0	1	17	3801	61	1861	1	808	2	1788	8	1963	**1,285**	**36,179**	***37,464***
																				Grand Total				**3,165**	**51,656**	***54,821***
																				Percent of Grand Total	→			**40.6%**	**70.0%**	**68.3%**

Appendix F User Benefit Results

User Benefit Information for MOS Option L 3MIN PK versus Baseline

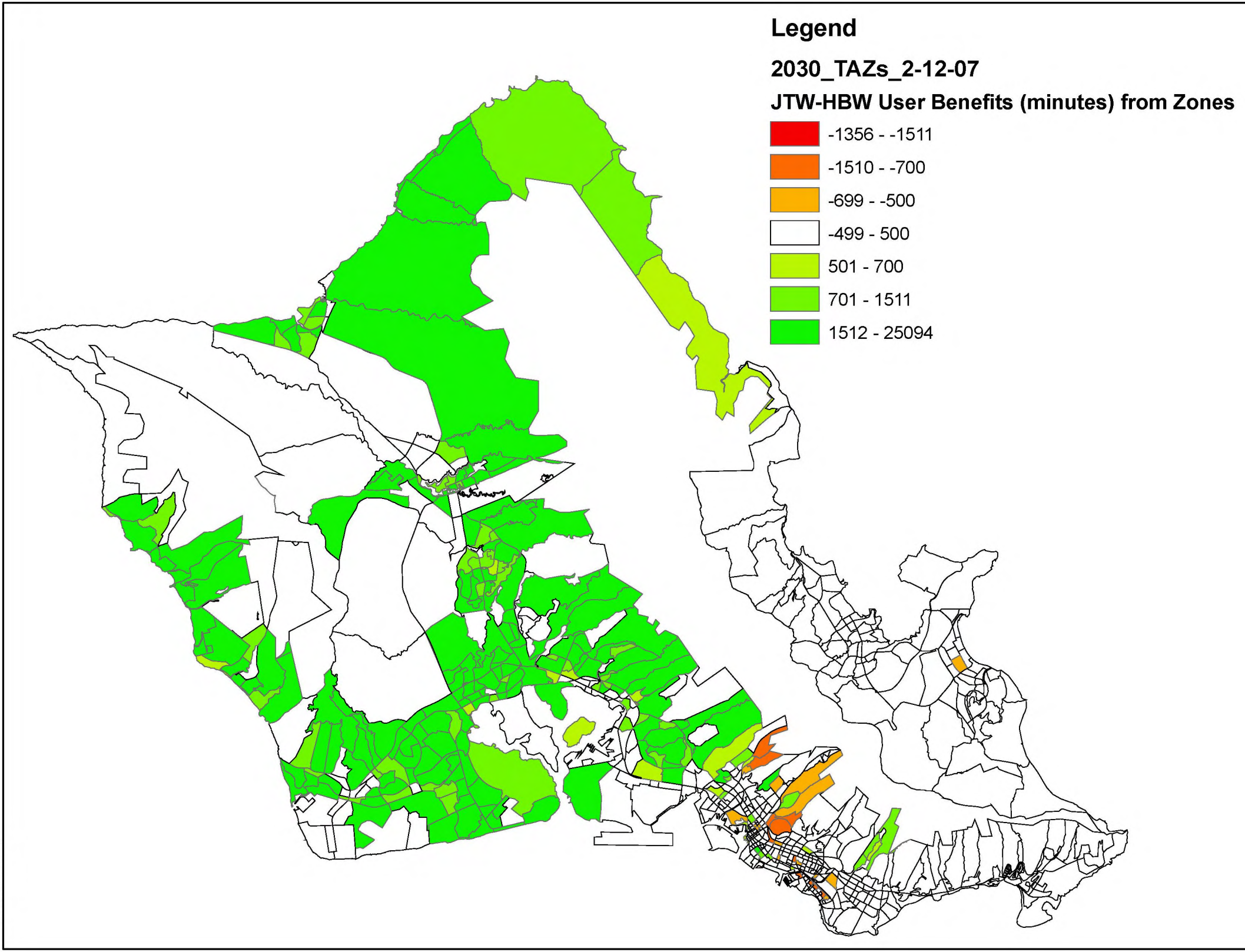
Source	Description	Journey to Work-HBW (WH)	Journey to Work-HBO (WO)	Journey to Work-Non-Based (WN)	Journey to Work-Work-Based (WW)	Journey at Work-Work Based (AW)	Journey at Work - Non-Based (AN)	NWR - Home Based K-12 (NK)	NWR - Home Based College (NC)	NWR - Home Based Shop (NS)	NWR - Home Based Other (NO)	NWR - Non-Home Based (NN)	Visitor Trips	Total
SUMMIT	Total User Benefits	850,158	33,111	3,189	67,071	18,878	112	263,714	250,935	46,437	231,278	52,380	31,126	1,848,389
	Capped User Benefits	815,487	31,239	3,105	64,829	21,512	110	243,655	234,192	45,244	221,121	50,524	30,859	1,761,877
	Percent of Total	46.3%	1.8%	0.2%	3.7%	1.2%	0.0%	13.8%	13.3%	2.6%	12.6%	2.9%	1.8%	100.0%
	Percent Capped	4.1%	5.7%	2.6%	3.3%	-14.0%	1.8%	7.6%	6.7%	2.6%	4.4%	3.5%	0.9%	4.7%
	Baseline Transit Trips	93,611	6,502	2,008	12,567	9,749	145	23,867	18,056	14,776	42,129	18,315	4,524	246,249
	Build Transit Trips	107,963	7,075	2,085	13,997	10,081	147	25,748	21,657	15,049	43,531	18,813	5,337	271,483
	New Riders	14,352	573	77	1,430	332	2	1,881	3,601	273	1,402	498	813	25,234
USERBENC	Existing Rider Statistics													
	Number	76,575	4,879	1,487	9,987	7,789	113	18,299	15,961	11,716	35,758	14,786	4,163	201,514
	Benefits(Minutes)	647,962	25,172	2,712	50,882	19,773	99	231,246	184,397	46,761	202,355	44,444	22,048	1,477,850
	User Benefit Per Existing Rider	8.5	5.2	1.8	5.1	2.5	0.9	12.6	11.6	4.0	5.7	3.0	5.3	7.3
	New Rider Statistics													
	Number	16,876	782	189	2,006	1,210	10	2,230	4,089	649	2,143	1,251	1,006	32,441
	Benefits(Minutes)	235,877	10,747	2,091	23,684	23,934	199	48,637	68,724	24,761	55,991	48,886	9,942	553,474
	User Benefit Per New Rider	14.0	13.7	11.1	11.8	19.8	19.5	21.8	16.8	38.2	26.1	39.1	9.9	17.1
	User Benefits with Urban Rail Available	864,291	33,873	4,012	70,820	23,943	164	228,738	267,147	45,426	217,550	52,507	31,539	1,840,010
	Percent of Uncapped Benefits	101.66%	102.30%	125.81%	105.59%	126.83%	146.52%	86.74%	106.46%	97.82%	94.06%	100.24%	101.33%	99.55%
	Non-included attributed UB's													
	all access transit markets	815,486	31,239	3,105	64,829	21,512	110	243,655	234,192	45,244	221,121	50,524	30,859	**1,761,876**
	in-vehicle time savings walk access	79,280	4,685	532	4,701	159	-	17,412	25,166	3,359	20,433	2,132	14,100	**171,959**
	guideway + local inveh savings walk access	126,016	7,398	996	8,360	176	-	28,259	39,529	5,423	32,769	4,043	24,552	**277,521**
	guideway only inveh savings walk access	41,934	3,625	1,334	6,134	1,233	-	4,524	9,614	6,757	20,576	9,396	15,167	**120,294**
	in-vehicle time savings PNR access	2,829	2	-	-	-	-	86	25	2	3	21		**2,968**
	guideway + local inveh savings PNR access	2,277	-	-	-	-	-	204	28	-	-	17		**2,526**
	guideway only inveh savings PNR access	6,685	15	-	-	-	-	203	58	15	15	87		**7,078**
	in-vehicle time savings KNR access	51,900	242	23	6,753	3,587	-	3,411	12,727	1,019	2,646	1,771		**84,079**
	guideway + local inveh savings KNR access	47,306	237	33	7,128	4,246	-	4,884	12,788	864	2,668	2,624		**82,778**
	guideway only inveh savings KNR access	92,597	537	87	19,256	25,868	-	3,886	22,852	5,032	7,990	9,802		**187,907**
	guideway only savings all access	1,266,310	47,979	6,110	117,161	56,781	110	306,524	356,978	67,713	308,218	80,415	84,679	**2,698,978**

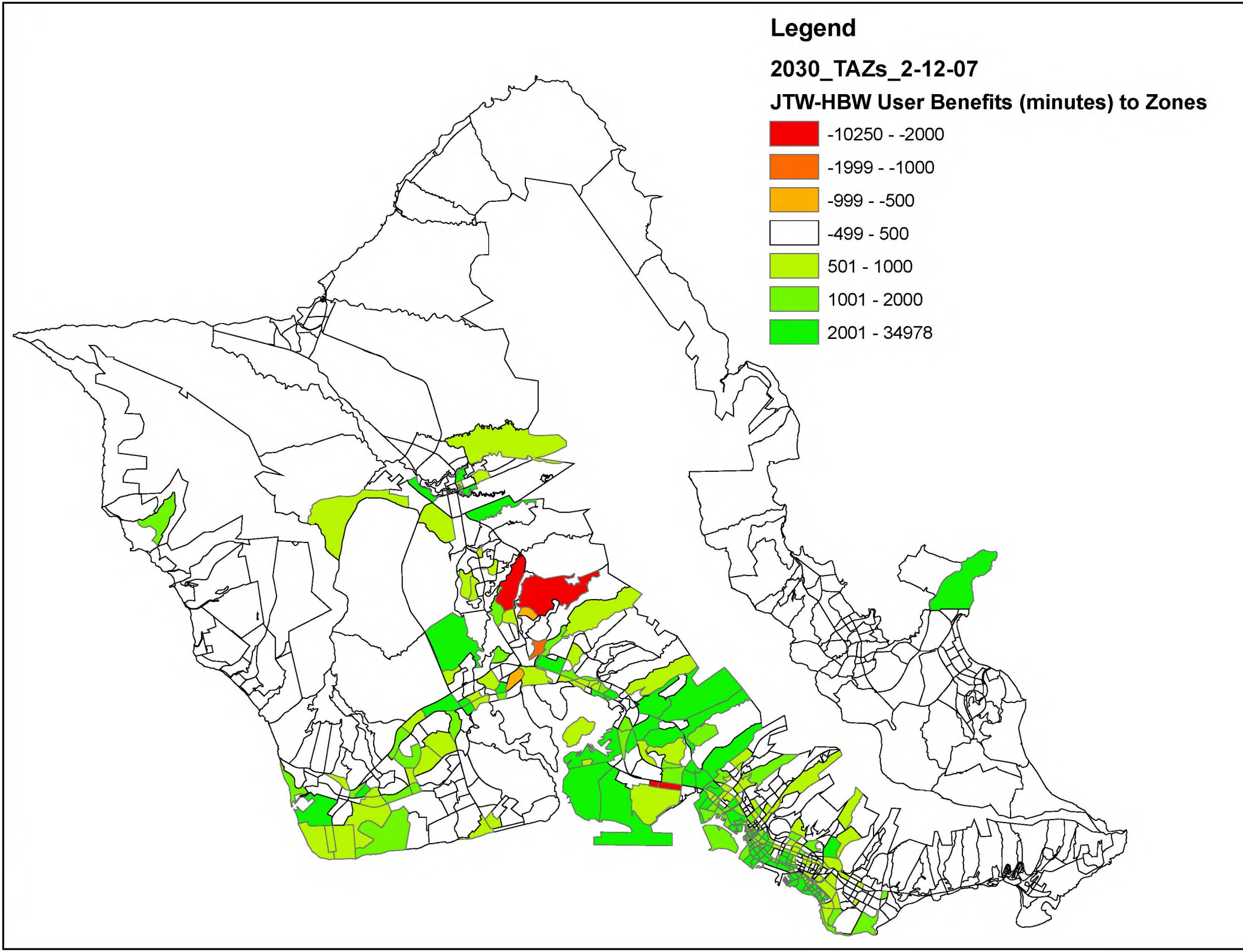
Date: 4/24/2007 **ONE SALT LAKE STATION**

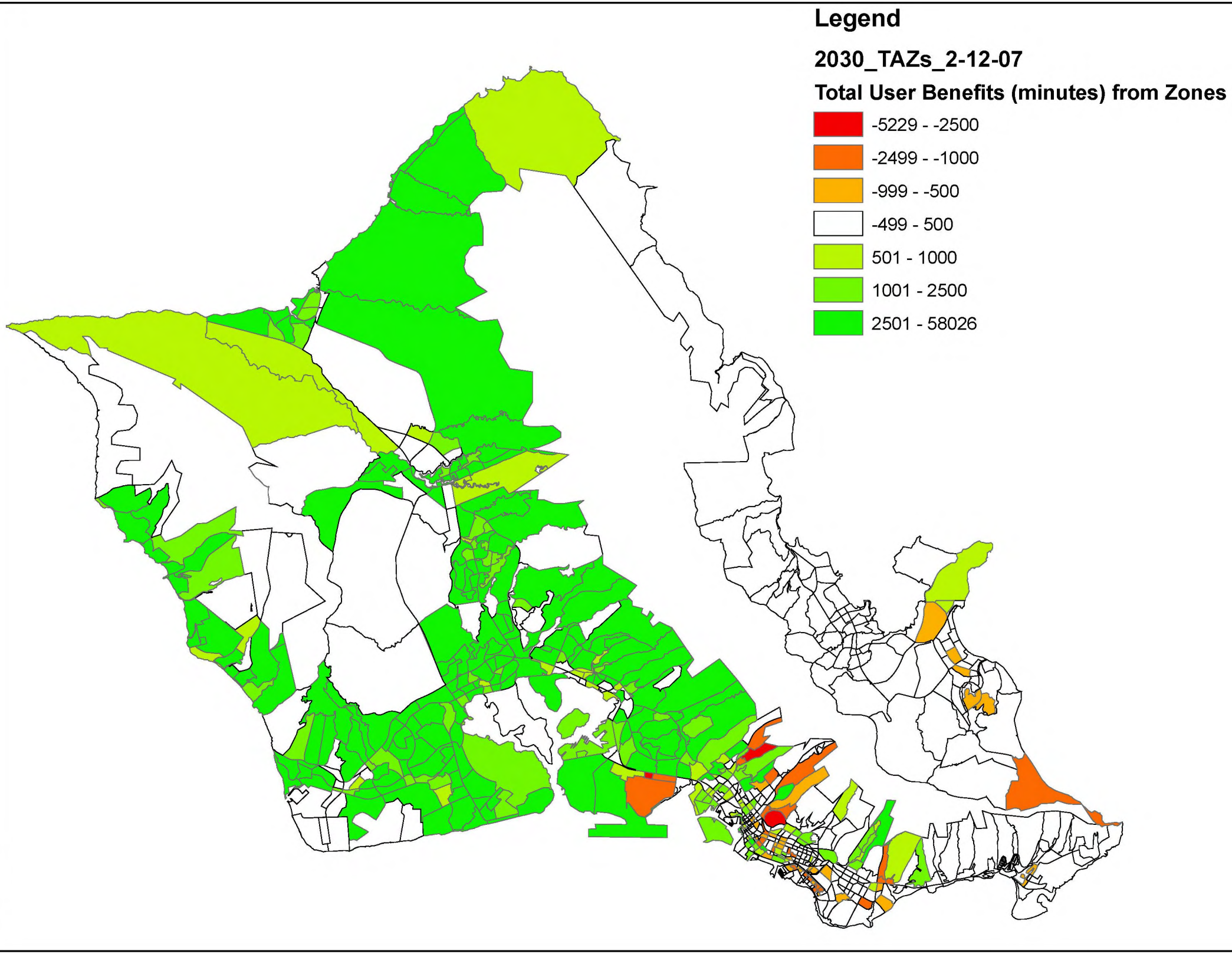
TSM FOR MOS L...using 4/24/07 MOS Option L 3 MIN PEAK HEADWAYS with NO non-included attribute.
New UserbenC & urban rail available thru drive access along with walk/bus access
Also NEW MC with NIA to PNR to fixed guideway
This is the FARRINGTON Model

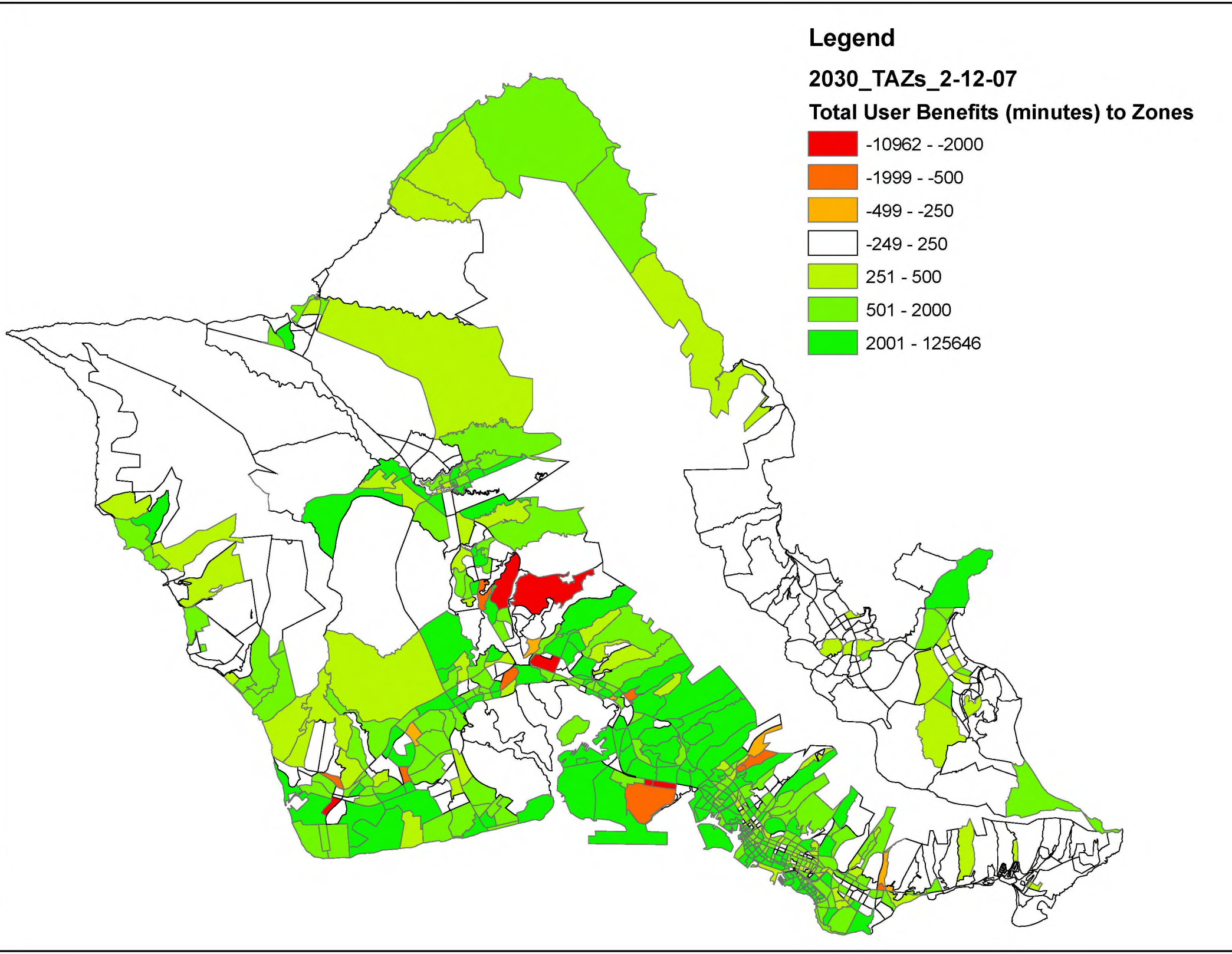
NO CAP FOR JTW-WH hlf

	Max benefit			Premium-only benefit												
Unincluded attribute	Premium only	Premium + local	Local	Portland	KC BRT	VRE	NY/CTA	BART	DC Metro	Street car	Manassas	Houston Busway	Honolulu			
													Baseline		Build	
													Premium	Local	Premium	Local
Guideway-like characteristics	**8.0**	**3.0**		**7.0**	**2.0**	**4.0**	**7.0**	**7.5**	**7.5**	**2.0**	**0.0**	**6.5**			**8.0**	**3.0**
- reliability of vehicle arrival	4.0	2.0		3.5	0.0	2.0	4.0	4.0	4.0	0.0	0.0	3.0			4.0	2.0
- branding/visibility/learnability	2.0	1.0		2.0	1.0	2.0	1.0	2.0	2.0	2.0	0.0	1.5			2.0	1.0
- schedule-free service	2.0	0.0		1.5	1.0	0.0	2.0	1.5	1.5	0.0	0.0	2.0			2.0	0.0
Span of good service	**3.0**	0.0		**3.0**	**1.0**	**0.0**	**3.0**	**3.0**	**3.0**	**2.0**	**0.0**	**1.5**			**3.0**	**0.0**
Passenger amenities	**4.0**	**3.0**		**2.5**	**2.0**	**3.0**	**1.5**	**4.0**	**4.0**	**1.0**	**0.0**	**1.0**			**3.5**	**2.5**
- stations/stops	3.0	2.0		1.5	1.0	2.0	1.5	3.0	3.0	0.0	0.0	1.0			2.5	1.5
- dynamic schedule information	1.0	1.0		1.0	1.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0			1.0	1.0
TOTAL	**15.0**	**6.0**		**12.5**	**5.0**	**7.0**	**11.5**	**14.5**	**14.5**	**5.0**	**0.0**	**9.0**			**14.5**	**5.5**
TARGET	**15.0**	**6.0**														
IVT coefficient	0.75*Civt		Civt	0.85	0.95	0.75	0.90	0.85	0.85	0.95	0.95	0.95			0.85	
- ride quality																
- vehicle amenities																
- reliability of travel time																
- availability of seat																


Legend
2030_TAZs_2-12-07
JTW-HBW User Benefits (minutes) from Zones
-1356 - -1511
-1510 - -700
-699 - -500
-499 - 500
501 - 700
701 - 1511
1512 - 25094


Legend
2030_TAZs_2-12-07
JTW-HBW User Benefits (minutes) to Zones
-10250 - -2000
-1999 - -1000
-999 - -500
-499 - 500
501 - 1000
1001 - 2000
2001 - 34978


Legend
2030_TAZs_2-12-07
Total User Benefits (minutes) from Zones
-5229 - -2500
-2499 - -1000
-999 - -500
-499 - 500
501 - 1000
1001 - 2500
2501 - 58026


Legend
2030_TAZs_2-12-07
Total User Benefits (minutes) to Zones
-10962 - -2000
-1999 - -500
-499 - -250
-249 - 250
251 - 500
501 - 2000
2001 - 125646

Appendix G NHB Direct Demand Estimation/ Application

DATE: **Monday, May 14, 2007**

FROM: **Joel Freedman & Rhett Fussell, PB**

TO: **Honolulu High-Capacity Transit AA Team**

RE: **NHB Direct Demand Estimation/Application**

Introduction

This memorandum describes work related to re-estimation, calibration, and application of a model to predict Non-Home-Based (NHB) rail trips based on Home-Based rail alightings and station density. This model is referred to as the Non-Home-Based Direct Demand model. The work follows on previous work conducted for the City and County of Honolulu by PB and COMSIS as part of the Honolulu Rapid Transit AA/DEIS in 1989.[1] Enhancements were made to the original model, including a Non-Home-Based trip distribution component and the ability to measure User Benefits for directly-generated trips. An application program was written in the Java programming language to apply the model and estimate user benefits for Honolulu.

Model re-estimation

The NHB direct-demand model generates trip ends at each rail station based on the number of Home-Based alightings at each station. Factors that vary by density of station are applied to Home-Based alightings to estimate NHB trip ends. These factors were re-estimated to take advantage of the new 2002 WMATA on-board rail survey.

Each station density in the DC area was determined by using a ½ mile buffer around them. The ½ mile assumption is consistent with the original approach in 1985, the assumptions used for walk access in the OMPO travel demand model and the calculation of station densities for the Oahu rail line. An assumption was made that land use is homogenous across the TAZ so that a consistent GIS approach could be applied when determining station densities. A more accurate measurement of density would require the use of parcel-level data, including land use type and employment totals/type. This is recommended for future re-estimation or research.

The results of the analysis showed differences in the estimated coefficients between the 1985 and 2002 surveys, as shown in Table 1. The NHB trip rates estimated with the more recent data are lower for all station types and modes, with very few exceptions. To determine the extent to which differences in the number of stations between the 1985 survey and the 2002 survey are responsible for the lower trip rates (there were 26 more stations in 2002), the model was re-estimated with only the stations that were

[1] For more information, see Alternatives Analysis and Draft Environmental Impact Statement: Task 5 – Service and Patronage Forecasting Methodology, for the City and County of Honolulu, by Parsons Brinckherhoff Quade and Douglas, and COMSIS Corporation, December 1989.

present in the 1985 survey. Given that there appears to be no significant difference between the estimation results with and without the 26 additional stations, it was concluded that the lower coefficients obtained with the 2002 data is not due to the additional stations.

Following are specific conclusions regarding the estimation data and results:

1) As noted, station NHB to Home-Based ratios are significantly lower using the 2002 data. The significance levels of estimation results are generally consistent with previous estimation results.
2) As previously estimated, less dense stations produce more NHB trip ends for each Home-Based alighting then more dense stations. The explanation provided with the previous study – that there are less opportunities for NHB trip attractions within walking distance of the station – is logical and appears to be supported by the new estimation results.
3) There are more Home-Based trips in the 2002 survey compared to the original 1985 survey. This could be due to ridership increases as well as changes in the on-board survey instrument.
4) The addition of 26 new stations in the 2002 survey provided more data points for the analysis and therefore change the regression analysis totals.
5) It is not intuitive why the bus or auto access trip rates are higher than the walk access trip rates in both the old estimation results and the new estimation results. Note that although there are small numbers of Home-Based attractions and Non-Home-Based trips that use auto as an egress mode, this is disallowed in the vast majority of trip-based travel demand models.
6) Numerous stations changed density type between 1985 & 2002. The density changes on the station types (or shifts from Type 2 to 3) obviously affect the estimation results. We are currently investigating different stratifications for station density to maximize the between-cell variation of trip rates with respect to density.

Table 1: NHB Direct Generation Rate Comparison

WMATA Summary 2002

	Density Type	Coeff	t-score
All Modes	1	0.331	38.18
R^2=.9645	2	0.495	23.86
	3	0.666	8.4
	4	1.055	6.83

	Density Type	Coeff	t-score
Walk	1	0.309	42.74
R^2=.9687	2	0.411	21.95
	3	0.565	6.18
	4	0.750	1.72

All non-motoroized travel

	Density Type	Coeff	t-score
Bus	1	0.414	12.73
R^2=.9021	2	0.563	15.96
	3	0.488	12.07
	4	0.614	12.11

	Density Type	Coeff	t-score
Auto	1	0.860	5.46
R^2=.8086	2	1.820	7.92
	3	3.210	9.63
	4	4.340	12.18

1985 WMATA Results

	Density Type	Coeff	t-score
All Modes	1	0.411	30.11
R^2=.953	2	0.725	15.29
	3	0.946	5.02
	4	1.644	2.37

	Density Type	Coeff	t-score
Walk	1	0.400	32.87
R^2=.958	2	0.661	14.59
	3	0.842	3.80
	4	0.866	0.47

All non-motoroized travel

	Density Type	Coeff	t-score
Bus	1	0.539	11.95
R^2=.907	2	0.837	18.05
	3	0.799	8.73
	4	0.782	3.90

	Density Type	Coeff	t-score
Auto	1	1.185	4.75
R^2=.810	2	2.417	10.11
	3	2.204	6.48
	4	4.094	9.02

Re-estimate using Only Original Stations

	Density Type	Coeff	t-score
All Modes	1	0.331	33.91
R^2=.9688	2	0.495	20.98
	3	0.640	6.78
	4	1.280	3.50

	Density Type	Coeff	t-score
Walk	1	0.309	35.72
R^2=.969	2	0.410	18.12
	3	0.568	4.97
	4	1.610	1.57

All non-motoroized travel

	Density Type	Coeff	t-score
Bus	1	0.414	12.19
R^2=.904	2	0.570	15.10
	3	0.470	10.40
	4	0.733	6.76

	Density Type	Coeff	t-score
Auto	1	0.860	6.04
R^2=.807	2	1.880	8.69
	3	2.800	8.60
	4	3.400	6.02

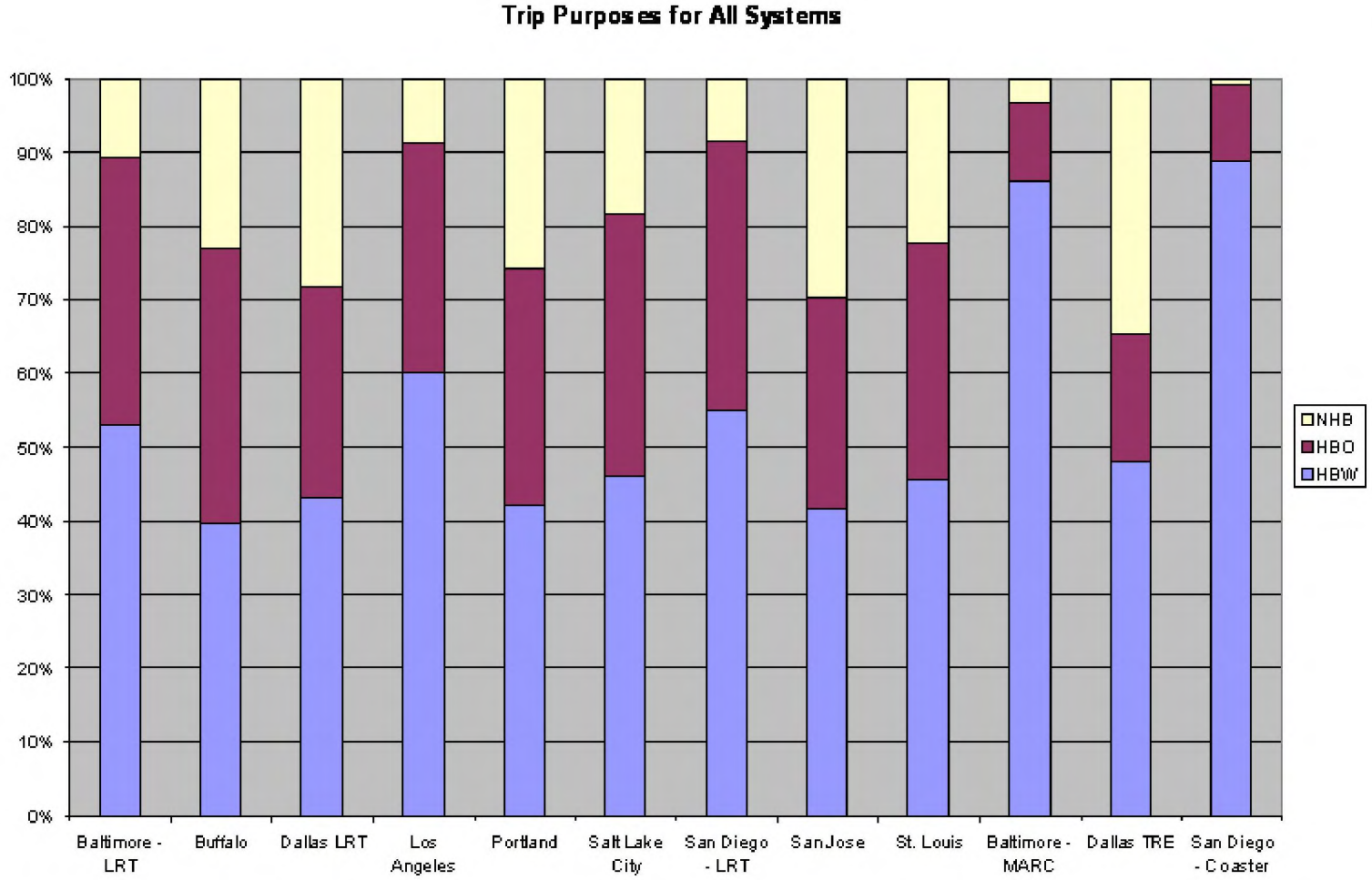
Model Application in Honolulu

The revised coefficients were applied to the MOSL alternative to calculate NHB trips and User Benefits. The coefficients for all modes were used as opposed to separate walk versus bus rates, since we could not find a logical explanation for why the bus rates would be higher for station types 1 and 2 and lower for stations 3 and 4. In any event, the rates are similar enough that the difference is not expected to affect the final results in any meaningful way. Station densities for MOSL stations were computed using a GIS technique consistent with the calculation performed for the WMATA stations. The resulting densities, classifications, Home-Based alightings, and NHB trip ends by station are given in Table 2. The table indicates that there are 69,758 Home-Based alightings (trips) predicted by the model, and 40,017 NHB trip ends, or 20,008 NHB trips. According to the model, 22% of total rail trips would be NHB. This compares reasonably well with an analysis of rail on-board survey data conducted by FTA and presented at the June 2006 workshop on New Starts forecasting held in Minneapolis (shown in Figure 1). Note that the Oahu MPO four-step travel model estimates only xx NHB rail trips, or xx percent of total rail trips, which is significantly lower than many on-board surveys indicate.

Table 2: MOSL Density, Station Type, Home-Based Alightings and Estimated NHB Trip Ends by Station

Station	Employment per Square Mile	Station Type	Home-Based Alightings	NHB Trip Ends
UH-WO	2,477	4	467	493
FarrNSRd	2,319	4	1,441	1,520
FarrEwaRd	1,950	4	333	351
LeokuFarr	5,442	3	1,124	749
MokuoFarr	3,391	3	795	529
LCC	687	4	3,352	3,536
PearlHigh	6,767	3	1,601	1,066
Kaonohi	13,089	2	3,415	1,690
Kahuapaani	4,643	3	7,707	5,133
SaltLkInoi	1,668	4	2,494	2,631
DlnghmMid	11,745	2	2,961	1,466
DlnghmMok	16,961	2	2,363	1,170
DlnghmKok	20,872	2	2,562	1,268
Kaaahi	17,792	2	1,007	498
NimiRiKe	31,041	2	1,504	744
HalekFort	175,528	1	5,867	1,942
HalekSouth	50,259	2	3,206	1,587
HalekWard	40,552	2	2,589	1,282
KonaKeeau	50,041	2	24,970	12,360
Total	74,739		69,758	40,017

Figure 1: Percent of Rail Trips by Purpose



Source: Travel Forecasting for New Starts Proposals, FTA Workshop, June 15-16, 2006, Minneapolis Minnesota

NHB Trip Distribution

A destination-choice trip distribution model was developed for Non-Home-Based trips to create a NHB rail station-station matrix. This matrix was then used to compute User Benefits for NHB trips. Destination choice models are very similar to mode choice models in that both are based on a type of discrete choice model called the *logit* model. As applied to destination choice models, the logit formulation is:

$$P_i(k) = \frac{\exp(U_{k|i})}{\sum_{j \in D} \exp(U_{j|i})}$$

where:

$P_i(k)$ is the probability of selecting attraction k, given production zone i,

$j \in D$ are the unique alternatives (attractions) in the sample set, and

U_j is the utility of selecting an attraction zone, given production zone i.

The equation states that given production zone *i*, the probability of selecting an attraction zone *k* is a function of the exponential utility of selecting *k* over the sum of exponential utilities of all attractions zones in the choice set. The larger the utility of travel between production zone *i* and attraction zone *j*, the greater the probability of travel between the zones.

The utility for a selecting a particular alternative (U_k) is a linear function of the attributes that describe the alternative. In a destination choice model, the attributes that describe the selection of a zone include its accessibility, other variables that describe the quality of the choice (in this case distance and distance raised to some power), and variables that describe the quantity of activity in the attraction zone:

$$U_{j|i} = \beta_1 \times accessibility_{j|i} + \beta_2 \times dist_{j|i} + \beta_3 \times dist_{j|i}^{\beta_4} + \ln(quantity_{j|i})$$

Utility functions for destination choice look different the comparable functions for mode choice models due to the logarithmic term. This term is referred to as the *size* term. The size term reflects the quantity of attractions in the destination zone (similar to a trip attraction model), and the logarithmic form of the term causes the probability of selecting the destination zone to be linear with respect to the number of attractions, all else being equal.

Destination choice models that use mode choice logsums as a measure of impedance have a special interpretation. The destination and mode models can be interpreted as sequentially estimated nested models. Mode choice becomes a nested choice under the choice of destination. The coefficient estimated on the mode choice logsum is interpreted as a nesting coefficient. Thus the coefficient must range be between 0 and 1. A value of 1 implies that there is no nesting. A value greater than 1 implies that the nesting order is incorrect.

The NHB Direct Demand model distributes NHB trips from each production *station* to each attraction *station* using the destination choice formula described above. The quantity used in

the Non-Home-Based Direct Demand model is the number of Non-Home-Based trip ends documented in Table 2 above.

For the NHB Direct Demand models, the walk-rail mode choice utility function was used as the measure of accessibility, as the model is distributing only NHB rail trips. The parameter values used in the NHB walk-rail utility are shown in Table 3. Note that there is no alternative-specific constant bonus for rail. Since the travel time and cost skims are zone-based, it was necessary to look up the closest zone to each station in order to index into the skims and find the appropriate skim value for each station-pair. A mode choice accessibility parameter of 0.75 was asserted.

Table 3: NHB Mode Choice Model Parameter for Rail

Description	Coefficient	Equivalent Minutes of IVT/Value of Time
In-vehicle time coefficient	-0.0200	1.0
Cost coefficient for medium income households (20-60k)	-0.0050	$2.40/hour
First wait coefficient--up to 5 minutes	-0.0400	2.0
First wait coefficient--in excess of 5 minutes	-0.0200	1.0
Transfer wait coefficient	-0.0500	2.5
Walk time coefficient	-0.0400	2.0

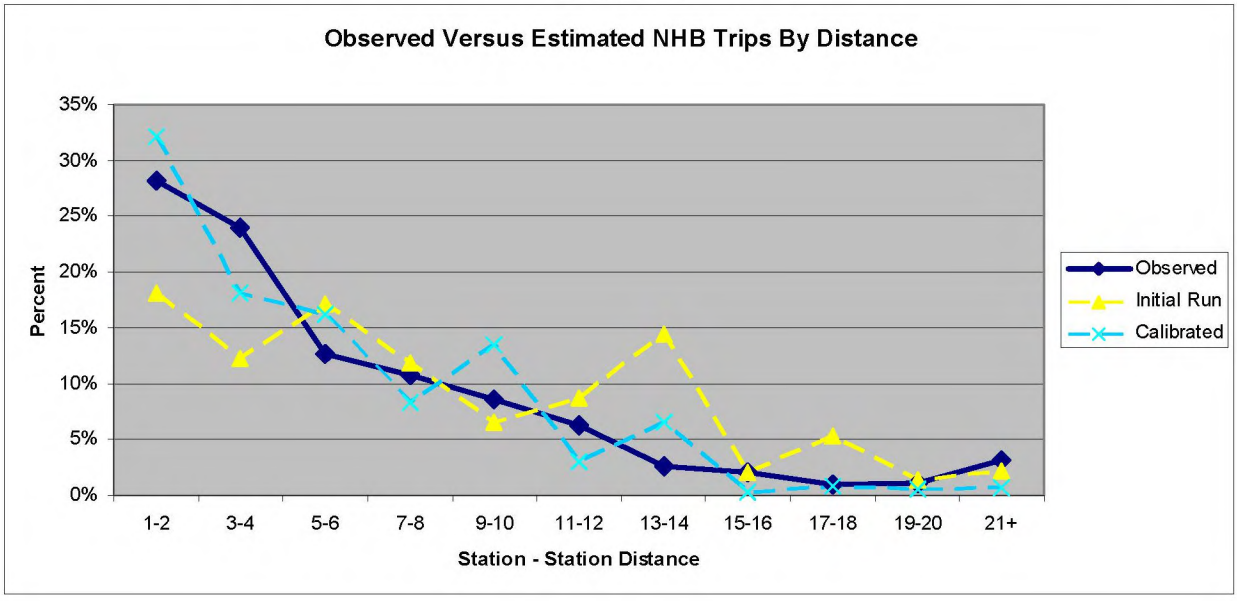
Just as a gravity model is balanced to match attractions if it is doubly constrained, a shadow pricing mechanism is used to match attractions in a destination choice model. The model is applied and the probability for each attraction station is computed for each production station. The probabilities are multiplied by the trips produced at each production station (In this case, NHB trip ends/2), and the resulting attractions are summed up by attraction station. If the station attractions predicted by the destination choice model are greater than the NHB trips generated, a shadow price is estimated as -ln(predicted/generated) and this term is added to the utility for the attraction zone. The model is iterated until the destination choice model predicts the correct number of trip attractions at each station according to the NHB direct demand trips generated.

It is often necessary to add distance-based parameters when calibrating a destination choice model that relies on a mode choice logsum as the measure of accessibility, due to the relatively limited distribution of the accessibility variable and the constraint that the logsum parameter must be between 0 and 1. After comparing the results of the trip distribution model to the WMATA NHB trip table, it was clear that additional calibration was necessary. Therefore a distance and a power-distance term was added to the destination choice utility equation, and the parameters on these terms were fitted to match the WMATA NHB rail trip length frequency distribution by distance (highway) between stations. Figure 2 shows the initial run distribution compared to the WMATA data, and the final calibrated model results.

The final utility equation for the NHB Direct Demand destination choice model is as follows:

$$U_{j|i} = 0.75 \times railUtility_{j|i} + -0.125 \times dist_{j|i} + -0.02 \times dist_{j|i}^{1.2} + \ln(NHBTripEnds_{j|i})$$

Figure 2: Observed (WMATA) versus Estimated (Oahu) NHB Rail Trips by Station Distance



Calculation of User Benefits

The calculation of user benefits for NHB Direct Demand trips required a simplifying assumption that those trips would have been made in the baseline alternative by the next best transit mode. The user benefits are computed as the difference between the cost of travel by rail in the build versus the cost of travel by bus in the baseline, multiplied by the number of NHB direct demand trips in the build scenario, and converted to equivalent minutes of travel time.

These calculations are performed within the Java application program as the FTA SUMMIT program is not structured to perform these calculations. In summary, the model predicts 20,008 NHB rail trips, and 8,016 hours of user benefits, for about 24 minutes of user benefit per NHB trip. Those benefits seem reasonable given the differences in transit accessibility (both in-vehicle time and headway are significantly improved) between the baseline and build alternatives. As previously noted, there is no alternative-specific constant bonus given to rail.

The following tables show the results of the Direct Demand models at a station-station level. Table 4 shows the station-station NHB trip table matrix. Table 5 is the station-station User Benefit matrix. Table 6 and Table 7 show the station-station transit in-vehicle time matrix for the baseline and MOSL build alternatives respectively.

Table 4: Station to Station NHB Trip Matrix

From Station	To Station																			Total
	UH-WO	FarrNS Rd	FarrEwa Rd	Leoku Farr	Mokuo Farr	LCC	Pearl High	Kaonohi	Kahuapaani	SaltLk Inoi	DInghm Mid	DInghm Mok	DInghm Kok	Kaaahi	Nimi RiKe	Halek Fort	Halek South	Halek Ward	Kona Keeau	
UH-WO	0	134	10	13	6	30	6	7	18	4	2	1	1	0	0	1	0	0	14	246
FarrNSRd	114	0	44	73	32	175	37	38	105	24	10	5	4	1	2	4	3	2	89	760
FarrEwaRd	11	58	0	13	6	31	6	7	19	4	2	1	1	0	0	1	0	0	16	176
LeokuFarr	13	99	13	0	15	81	17	18	50	11	5	2	2	1	1	2	1	1	43	374
MokuoFarr	6	47	6	16	0	66	14	15	40	9	4	2	2	0	1	1	1	1	35	265
LCC	34	127	37	96	72	0	206	156	434	100	40	20	18	5	7	15	11	7	382	1,768
PearlHigh	7	27	8	20	15	206	0	33	91	21	8	4	4	1	1	3	2	2	80	533
Kaonohi	8	31	8	21	16	159	33	0	234	55	22	11	10	3	4	8	6	4	211	845
Kahuapaani	22	82	21	54	41	405	85	215	0	266	89	53	48	15	18	42	31	20	1,056	2,566
SaltLkInoi	4	14	5	12	9	92	19	50	257	0	54	31	30	10	11	25	19	13	660	1,316
DInghmMid	2	7	2	4	4	35	7	20	87	54	0	19	19	6	7	17	12	8	423	733
DInghmMok	1	3	1	2	2	17	4	10	55	32	19	0	16	5	7	15	11	7	378	585
DInghmKok	1	3	1	2	2	18	4	10	48	28	18	16	0	6	7	17	13	8	431	634
Kaaahi	0	1	0	1	1	6	1	4	15	9	6	5	6	0	3	7	5	3	176	249
NimiRiKe	0	1	0	1	1	7	1	4	19	12	7	7	8	3	0	11	8	5	277	372
HalekFort	1	3	1	2	2	17	3	10	46	27	17	16	18	7	11	0	22	14	754	971
HalekSouth	1	2	1	1	1	11	2	7	32	19	11	11	12	5	8	22	0	12	635	793
HalekWard	0	1	0	1	1	7	2	4	21	13	7	7	8	3	5	15	12	0	531	641
KonaKeeau	22	80	18	44	41	409	86	240	1,001	629	413	377	429	176	279	767	635	533	0	6,180
Total	247	723	176	375	265	1,772	534	847	2,571	1,318	734	586	635	250	373	973	795	642	6,192	20,008

Table 5: Station-station NHB user benefit matrix (cost difference)

From Station	To Station: UH-WO	FarrNS Rd	FarrEwa Rd	Leoku Farr	Mokuo Farr	LCC	Pearl High	Kaonohi	Kahuapaani	SaltLk Inoi	Dlnghm Mid	Dlnghm Mok	Dlnghm Kok	Kaaahi	Nimi RiKe	Halek Fort	Halek South	Halek Ward	Kona Keeau	Total	Per Trip
UH-WO	0	881	-188	-313	-176	-1,747	-366	-308	-787	-277	-87	-23	-19	-6	-8	-22	-17	-13	-469	**-3,945**	**-16**
FarrNSRd	382	0	-182	-674	-488	-8,521	-1,784	-1,423	-3,679	-1,249	-389	-73	-51	-16	-25	-79	-65	-55	-1,521	**-19,891**	**-26**
FarrEwaRd	-92	-156	0	-52	-80	-1,472	-308	-250	-647	-302	-109	-28	-37	-7	-10	-26	-20	-15	-568	**-4,180**	**-24**
LeokuFarr	-141	-444	-13	0	-133	-3,466	-726	-568	-1,459	-766	-267	-88	-89	-23	-21	-57	-50	-33	-1,801	**-10,144**	**-27**
MokuoFarr	-102	-558	-81	-97	0	-2,077	-435	-405	-1,192	-848	-233	-91	-82	-28	-25	-64	-60	-34	-1,852	**-8,263**	**-31**
LCC	-1,489	-4,575	-1,391	-2,906	-2,068	0	-1,845	-6,122	-17,748	-10,293	-3,108	-1,210	-1,092	-360	-490	-1,200	-899	-652	-27,482	**-84,930**	**-48**
PearlHigh	-312	-957	-291	-608	-433	-1,844	0	-1,281	-3,714	-2,154	-650	-253	-229	-75	-103	-251	-188	-137	-5,752	**-19,233**	**-36**
Kaonohi	-193	-605	-172	-368	-252	-4,847	-1,015	0	-3,040	-3,286	-954	-365	-287	-92	-127	-342	-267	-194	-8,087	**-24,493**	**-29**
Kahuapaani	-290	-779	-226	-481	-356	-9,858	-2,064	-1,004	0	-9,800	-1,928	-588	-378	-134	-232	-781	-653	-523	-17,397	**-47,471**	**-18**
SaltLkInoi	-187	-538	-303	-759	-489	-6,217	-1,302	-2,272	-9,050	0	-457	-1,142	-870	-169	-298	-824	-698	-488	-22,008	**-48,070**	**-37**
DlnghmMid	-70	-142	-54	-125	-153	-2,298	-481	-691	-1,673	-1,993	0	-513	-357	-44	-121	-375	-317	-228	-9,690	**-19,324**	**-26**
DlnghmMok	-13	-10	-26	-51	-45	-709	-149	-217	-443	-1,289	-548	0	-76	-58	-112	-332	-243	-226	-7,207	**-11,752**	**-20**
DlnghmKok	-23	0	-17	-38	-44	-708	-148	-205	-290	-823	-461	-46	0	-24	-70	-247	-242	-216	-6,351	**-9,952**	**-16**
Kaaahi	-3	1	-7	-15	-15	-237	-50	-44	-130	-127	-160	-101	-89	0	-18	-81	-78	-80	-3,281	**-4,517**	**-18**
NimiRiKe	-7	-10	-10	-23	-26	-371	-78	-102	-316	-252	-226	-114	-92	-15	0	-99	-105	-83	-2,407	**-4,336**	**-12**
HalekFort	-20	-38	-27	-31	-50	-1,019	-213	-301	-952	-753	-631	-346	-363	-79	-158	0	-214	-175	-10,002	**-15,370**	**-16**
HalekSouth	-15	-29	-11	-21	-34	-645	-135	-229	-704	-694	-475	-226	-196	-101	-154	-216	0	-123	-8,069	**-12,078**	**-15**
HalekWard	-10	-21	-9	-17	-25	-441	-92	-133	-548	-422	-268	-178	-163	-72	-86	-181	-156	0	-4,266	**-7,090**	**-11**
KonaKeeau	-323	-311	-482	-1,104	-1,464	-23,190	-4,856	-6,089	-11,242	-17,255	-12,613	-6,713	-5,940	-1,864	-5,711	-12,748	-9,831	-4,203	0	**-125,940**	**-20**
Total	**-2,907**	**-8,292**	**-3,487**	**-7,683**	**-6,332**	**-69,668**	**-16,047**	**-21,644**	**-57,613**	**-52,582**	**-23,565**	**-12,100**	**-10,409**	**-3,166**	**-7,770**	**-17,924**	**-14,103**	**-7,477**	**-138,209**	**-480,978**	**-24**
Per Trip	**-12**	**-11**	**-20**	**-20**	**-24**	**-39**	**-30**	**-26**	**-22**	**-40**	**-32**	**-21**	**-16**	**-13**	**-21**	**-18**	**-18**	**-12**	**-22**	**-24**	

Table 6: Station-Station Baseline Transit In-vehicle Time Matrix

From Station	To Station: UH-WO	FarrNS Rd	FarrEwa Rd	Leoku Farr	Mokuo Farr	LCC	Pearl High	Kaonohi	Kahuapaani	SaltLk Inoi	DInghm Mid	DInghm Mok	DInghm Kok	Kaaahi	Nimi RiKe	Halek Fort	Halek South	Halek Ward	Kona Keeau	Weighted Average
UH-WO	0	3	17	24	24	34	34	50	62	61	38	40	44	46	50	52	54	61	61	**21**
FarrNSRd	3	0	9	16	22	31	31	47	59	56	33	36	39	42	46	48	49	57	56	**26**
FarrEwaRd	11	5	0	7	15	24	24	38	51	60	62	39	70	45	49	51	53	64	60	**26**
LeokuFarr	15	9	4	0	7	17	17	31	43	48	55	43	62	32	35	37	39	57	60	**20**
MokuoFarr	19	14	8	4	0	10	10	25	41	60	51	62	68	71	44	44	48	50	53	**23**
LCC	24	19	14	10	5	0	0	16	31	50	40	53	58	61	66	68	74	79	65	**24**
PearlHigh	24	19	14	10	5	0	0	16	31	50	40	53	58	61	66	68	74	79	65	**28**
Kaonohi	30	24	19	18	13	8	8	0	14	44	24	35	32	34	38	40	41	45	48	**27**
Kahuapaani	35	29	24	20	20	15	15	7	0	24	12	22	19	21	25	27	29	33	36	**23**
SaltLkInoi	51	45	61	57	37	31	31	30	23	0	9	26	23	20	25	27	31	36	40	**32**
DInghmMid	49	37	38	34	31	51	51	27	14	21	0	8	15	12	17	19	23	27	32	**26**
DInghmMok	26	20	47	43	38	33	33	25	19	23	4	0	5	9	13	16	22	27	22	**24**
DInghmKok	50	23	39	35	42	36	36	20	15	18	7	3	0	4	8	10	10	21	17	**19**
Kaaahi	31	25	41	37	32	27	27	19	17	14	13	7	4	0	5	7	11	15	20	**15**
NimiRiKe	32	26	42	38	47	41	41	22	18	17	13	8	5	3	0	2	8	11	10	**13**
HalekFort	34	28	44	31	26	43	43	23	19	20	15	15	8	6	2	0	3	9	9	**11**
HalekSouth	38	32	37	33	28	51	51	29	36	25	20	18	15	7	4	2	0	5	11	**9**
HalekWard	40	34	41	37	32	50	50	32	36	28	25	17	14	11	10	9	6	0	7	**22**
KonaKeeau	47	41	52	49	45	59	59	33	28	32	29	20	14	16	14	14	12	7	0	**11**
Weighted Average	**16**	**13**	**20**	**17**	**17**	**18**	**21**	**25**	**29**	**32**	**22**	**20**	**17**	**14**	**14**	**13**	**11**	**29**	**12**	**23**

Table 7: Station-Station Build Transit In-vehicle Time Matrix

From Station	To Station: UH-WO	FarrNS Rd	FarrEwa Rd	Leoku Farr	Mokuo Farr	LCC	Pearl High	Kaonohi	Kahuapaani	SaltLk Inoi	Dlnghm Mid	Dlnghm Mok	Dlnghm Kok	Kaaahi	Nimi RiKe	Halek Fort	Halek South	Halek Ward	Kona Keeau	**Weighted Average**
UH-WO	0	2	5	7	9	12	12	16	19	23	26	28	30	31	33	34	36	37	39	**8**
FarrNSRd	2	0	3	6	8	10	10	15	18	21	25	27	28	30	32	33	34	36	38	**11**
FarrEwaRd	5	3	0	2	5	7	7	11	14	18	21	23	25	26	28	29	31	32	34	**10**
LeokuFarr	7	6	2	0	2	5	5	9	12	16	19	21	23	24	26	27	29	30	32	**8**
MokuoFarr	9	8	5	2	0	2	2	7	10	13	17	19	20	22	24	25	26	28	30	**8**
LCC	12	10	7	5	2	0	0	5	7	11	15	16	18	19	21	23	24	25	28	**7**
PearlHigh	12	10	7	5	2	0	0	5	7	11	15	16	18	19	21	23	24	25	28	**9**
Kaonohi	16	15	11	9	7	5	5	0	3	6	10	12	13	15	17	18	20	21	23	**10**
Kahuapaani	19	18	14	12	10	7	7	3	0	3	7	9	10	12	14	15	17	18	20	**10**
SaltLkInoi	23	21	18	16	13	11	11	6	3	0	4	6	7	9	11	12	13	15	17	**12**
DlnghmMid	26	25	21	19	17	15	15	10	7	4	0	2	3	5	7	8	10	11	13	**9**
DlnghmMok	28	27	23	21	19	16	16	12	9	6	2	0	1	3	5	6	8	9	11	**9**
DlnghmKok	30	28	25	23	20	18	18	13	10	7	3	1	0	2	4	5	6	8	10	**8**
Kaaahi	31	30	26	24	22	19	19	15	12	9	5	3	2	0	2	3	5	6	8	**7**
NimiRiKe	33	32	28	26	24	21	21	17	14	11	7	5	4	2	0	1	3	4	6	**6**
HalekFort	34	33	29	27	25	23	23	18	15	12	8	6	5	3	1	0	1	3	5	**5**
HalekSouth	36	34	31	29	26	24	24	20	17	13	10	8	6	5	3	1	0	1	3	**4**
HalekWard	37	36	32	30	28	25	25	21	18	15	11	9	8	6	4	3	1	0	2	**12**
KonaKeeau	39	38	35	32	30	28	28	23	20	17	13	11	10	8	6	5	4	2	0	**5**
Weighted Average	**9**	**9**	**10**	**8**	**9**	**8**	**9**	**10**	**10**	**12**	**9**	**9**	**8**	**7**	**6**	**5**	**4**	**12**	**5**	**10**